COMPUTING FOR HOME AND BUSINESS

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SMALL BUSINESS COMPUTERS: Finding One that Works for You

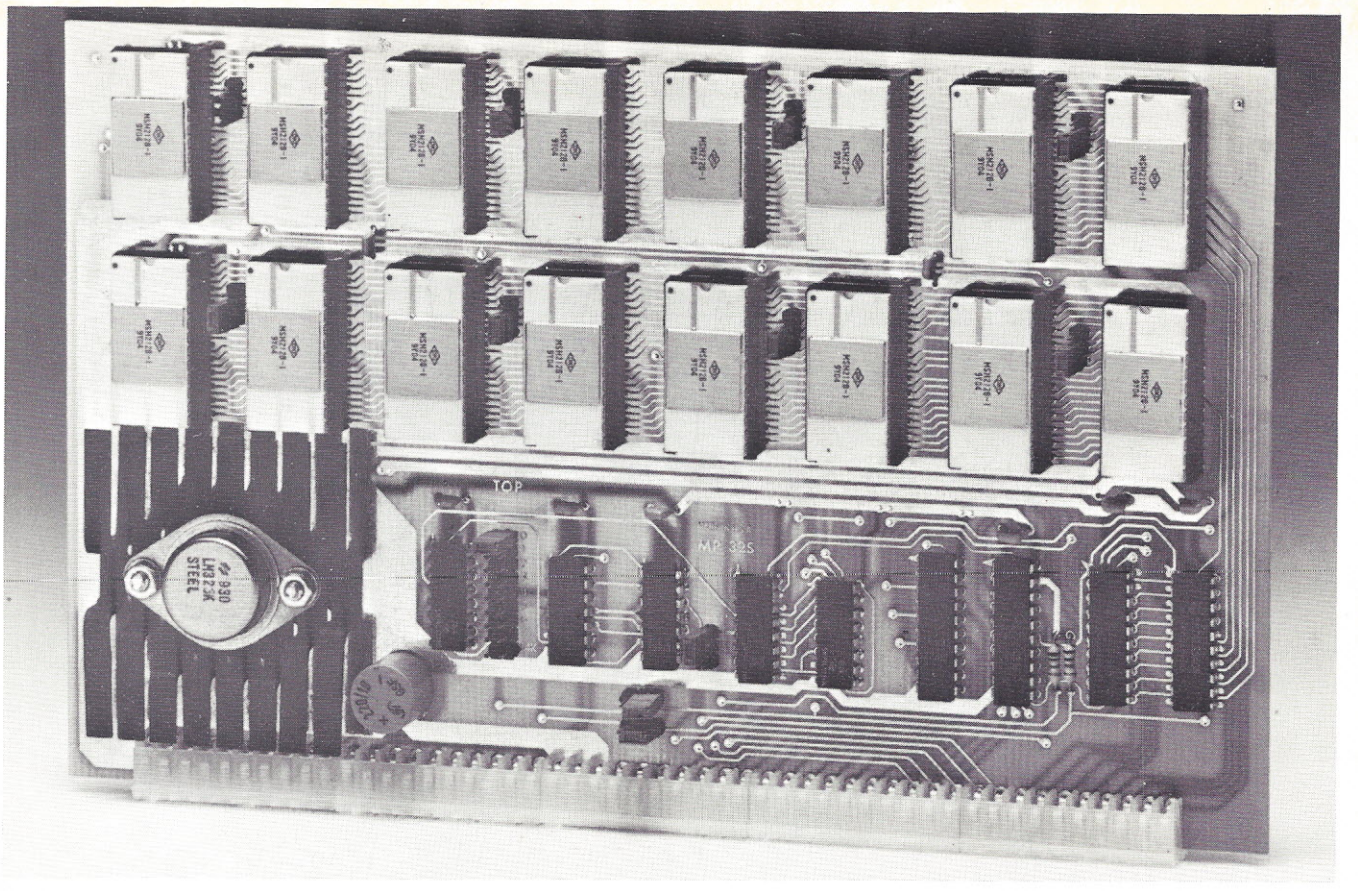


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CIRCLE INQUIRY NO. 70



Low-cost hard disk computers are here and field proven

11 megabytes of hard disk and 64 kilobytes of fast RAM in a Z80A computer for under $10K. Two floppy drives, too. Naturally, it's from Cromemco.

It's a reality. In Cromemco's new Model Z-2H you get all of the above and even more. With Cromemco you get it all.

In this new Model Z-2H you get not only a large-storage Winchester hard disk drive but also two floppy disk drives. In the hard disk drive you get unprecedented storage capacity at this price—11 megabytes unformatted.

You get speed—both in the 4 MHz Z80A microprocessor and in the fast 64K RAM which has a chip access time of only 150 nanoseconds. You get speed in the computer minimum instruction execution time of 1 microsecond. You get speed in the hard disk transfer rate of 5.6 megabits/sec.

EXPANDABILITY

You get expandability, too. The high-speed RAM can be expanded to 512 kilobytes if you wish.

And the computer has a full 12-slot card cage you can use for additional RAM and interface cards.

BROADEST SOFTWARE SUPPORT

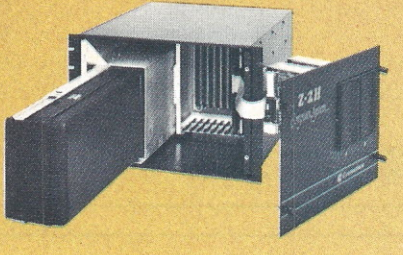
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- **Extended BASIC**
- **FORTRAN IV**
- **RATFOR (RATional FORtran)**
- **COBOL**
- **Z80 Macro Assembler**
- **Word Processing System**
- **Data Base Management**

with more coming all the time.

SMALL, RUGGED, RELIABLE

With all its features the new Z-2H, including its hard disk drive, is still housed in just one compact cabinet.



Hard disk drive at lower left can be interchanged just by sliding out and disconnecting plug. Seven free card slots are available. Z-2H includes printer interface card.

Included in that cabinet, too, is Cromemco ruggedness and reliability. Cromemco is time-proved. Our equipment is a survey winner for reliability. Of course, there's Cromemco's all-metal cabinet. Rugged, solid. And, there's the heavy-duty power supply (30A @ 8V, 15A @ +18 V, and 15A @ −18V) for circuitry you'll sooner or later want to plug into those free card slots.

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VOL. 5, ISSUE 5
SINCE DECEMBER 1975

MAY 1980

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COMPUTING FOR HOME AND BUSINESS APPLICATIONS

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This Weekend:

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LIGHTPEG (4 peg-jump puzzles)
ENDRUN (Othello with a 'twist')
LIFE9 (Conway's LIFE with mutations)
Price: $19.95 (including postage & handling)

LIGHT-PAK 3- (LEVEL II)
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STIKWUMPUS (Caves with a little 'life')
MAZEMASTER (Maze after maze to poke thru)
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Order yours now and we'll include a free copy of FLASHBACK, Esmark's newsletter dedicated to the latest news in lightware applications. And don't forget to tell your friends. The VIDIET-STIK can also be ordered for use on most other micro systems using the following processor chips:

8080 Z80 6800 6502

All that's required is a standard cassette jack leading to Ground and a readable single bit input port. Driver software is provided along with instructions for writing lightware applications. And tell your local Dealer that Esmark's got a Dealer package he won't want to miss out on. Delivery is 3 to 6 weeks from receipt of your order. C.O.D.'s are $3.00 extra but will be shipped within 2 weeks. All prices are F.O.B. Mishawaka, Indiana. Indiana residents add 4% sales tax.

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- TRS-80 Printer Interface (Cassette AUX-jack interface for all RS232 prints. Includes LLIST & LPRINT software)
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CIRCLE INQUIRY NO. 27

EDITOR'S NOTEBOOK

As we go to press, IBM has just announced its 5120 computing system, the lowest-priced IBM system to date. With the purchase price ranging from $9,340 to $23,990, this system represents one important step toward computer power at a price feasible for the small businessman.

A representative configuration which includes a main storage (RAM) capacity of 32,768 characters of information, a 120 character-per-second printer and the BASIC programming language, can be purchased for less than $13,500.

This new system is built around a computer (5110 model 3) with the base about the size of a large typewriter, yet contains the computing power of a system that would have weighed a ton and filled a small room 20 years ago.

To assist customers in the installatino of this system, IBM has set up a toll-free "Hot Line" in Atlanta.

Only time will tell just how much help can be offered on the phone. Anyhow, it is a step by IBM to come into the world of small business systems.

Here are the features and prices of the system:

STANDARD FEATURES

- A nine-inch diagonal CRT with 16 lines of 64 characters totaling 1,024 characters, and upper and lower case display under program control;
- Two integrated diskette drives with 1.2 megabytes of storage each;
- Configuration flexibility of from 16K to 64K main storage;
- Choice of BASIC or APL or both;
- Compatible with an IBM 5110 with like features;
- Programmable full screen management including automatic cursor position and CRT on/off control;
- Audible alarm, which signals the operator that attention is required by way of system control or user program control;
- A typewriter-like keyboard plus a separate 10-key numeric pad. Keytops indicate special characters for BASIC and/or APL, depending on the model. Four operator keys located on the numeric pad provide arithmetic functions;
- System control switches and status indicator lights are readily accessible to the right of the CRT;
- Composite video adapter providing the capability for simultaneous display of CRT data on additional TV monitor screens.

OPTIONAL FEATURES

- Diskette sort, resident in read-only storage for full record sorting or record address sorting from either BASIC or APL programs; sort key can contain up to six sort control fields and control statements can be stored on diskette or entered from the keyboard via prompting message;
- Serial I/O adapter, an external device attachment at five, six, seven and eight-bit transaction codes operating in conjunction with BASIC or APL programs;
- Binary synchronous communications adapter, which allows the 5120 to function on a switched or non-switched communications line at transmission rates of up to 4,800 bps as a processor terminal emulating 3741 line protocol or 2770 in conjunction with BASIC or APL program control;
- Asynchronous communications adapter, which provides 2741 compatibility using start/stop discipline at transmission speeds of 134.5 bps or 300 bps over switched and non-switched lines.

The system licensed programs are cross-industry packages designed to provide the user with tools for running and managing a business. They are: General Ledger, Accounts Payable, Payroll, Billing, Inventory Reporting and Accounts Receivable.

Highlights common to all programs include:

- Interrelated applications through generation and passing of transaction data on diskettes for direct input as appropriate;
- New approach to program documentation designed to significantly increase ease-of-use and customer self-sufficiency during installation and operation;
- Installation Support Center support with direct customer "hot line" for questions related to the installation and operation of these applications;
- Enhanced ease-of-use through appropriate operation of menu-driven selection of procedures and/or screen prompting;
- Built-in auditability and control through such techniques as zero balancing and control totals.

5120 COMPUTING SYSTEM PRICES

5110 Model 3 Computer

Model	Language	Main Storage	Price
A31	APL	16K	$ 9,990
A32	APL	32K	$10,775
A33	APL	48K	$11,560
A34	APL	64K	$12,345
B31	BASIC	16K	$ 9,160
B32	BASIC	32K	$ 9,945
B33	BASIC	48K	$10,730
B34	BASIC	64K	$11,515
C31	APL & BASIC	16K	$10,820
C32	APL & BASIC	32K	$11,605
C33	APL & BASIC	48K	$12,930
C34	APL & BASIC	64K	$13,175

5103 Printers

Model	Speed	Price
11	80 cps	$2,655
12	120 cps	$3,070

5114 Diskette Units

Model	Capacity	Price
001	1.2 MB	$3,445
001	2.4 MB	$5,155

5110 Model 3 Options

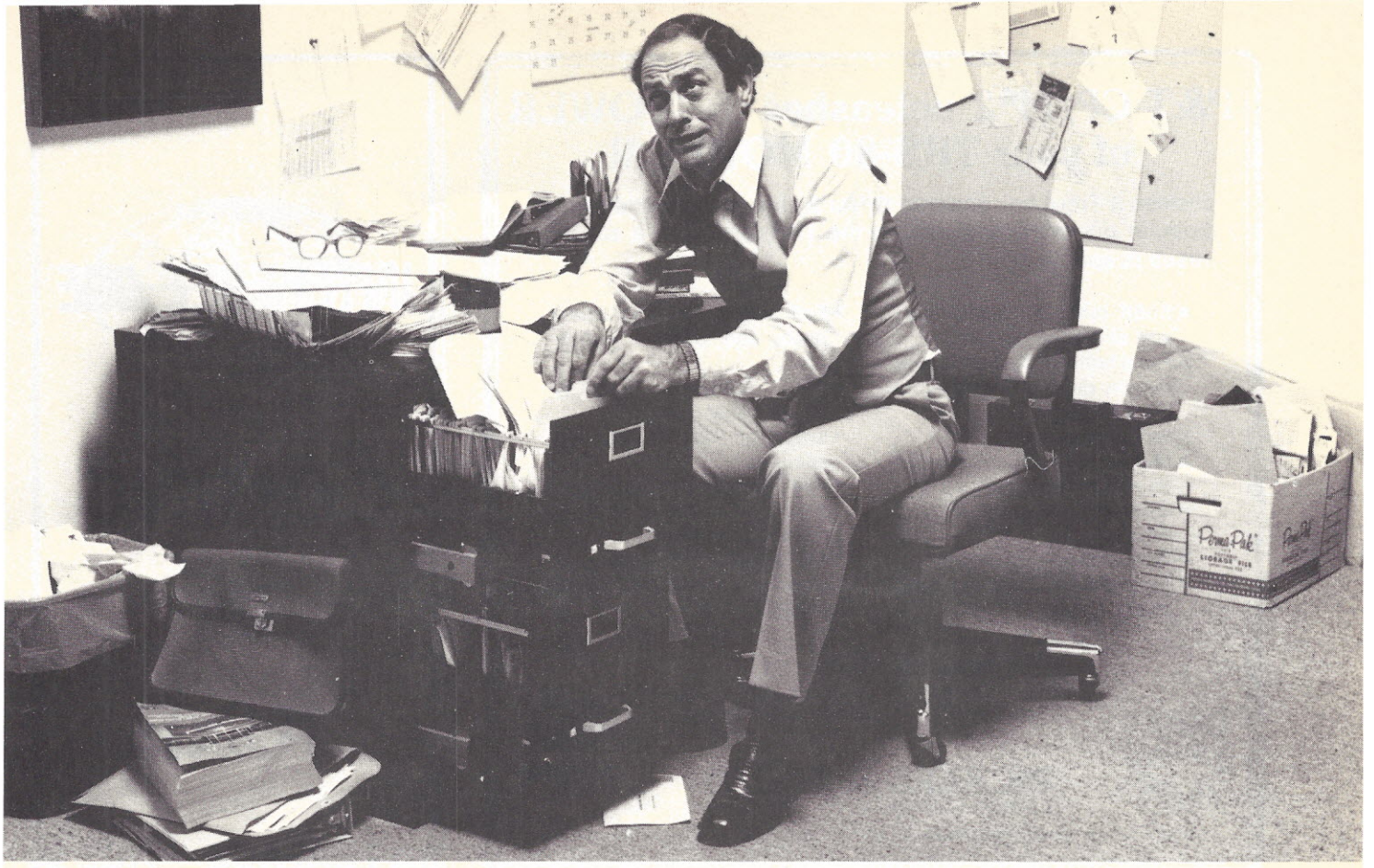
Diskette sort	$ 360
Serial I/O adapter	$ 630
Binary synchronous communications adapter	$1,800
Asynchronous communications adapter	$ 540
Expansion Feature*	$ 270
Channel Terminator**	$ 180
EIA/CCITT Interface***	$ 430

*Required for attachment of serial I/O or asynchronous communication adapters

**Required when the IBM 5103 printer is not attached.

***Required with binary asynchronous communications adapter.

□



Record keeping problems? Our CCA Data Management System solves them easily.

Having information at your fingertips can make your job a whole lot easier. And that's what the CCA Data Management System is all about.

With this Personal Software™ package and an Apple II™ or TRS-80™ disk system, it will be far easier to keep inventories, customer lists, accounts receivable and payable records, patient histories and many more items.

In fact, you can use the CCA DMS for all of your data management needs, rather than buying (expensive) or writing (time consuming) separate programs for each application. That's because DMS lets you create your own filing systems, adapting itself to the types of records you keep. You specify the number and names of each data field—without any programming.

With DMS keeping all of your records, you only have to learn how to use one system. That's easier, too. It's menu driven, with plenty of prompts to help you create files and add, update, scan, inspect, delete, sort, condense and print data. Our comprehensive 130-page step-by-step instruction manual even provides complete "how to" inventory and mailing list applications so you can start processing immediately.

DMS is a very powerful system, with more file and record storage capacity than other data base programs on the market.



And it also gives you greater data handling flexibility. To customize DMS, write add-on BASIC programs that read or write DMS files and perform any kind of processing you want.

You can sort and print your data in nearly any form of report and mailing label you want. Sort data by up to 10 fields for zip code, balance due, geographic location or whatever. And print reports with subtotals and totals automatically calculated.

The CCA Data Management System, written by Creative Computer Applications, has two years of field testing on other microcomputers. Now Personal Software makes DMS available on the TRS-80 Level II and Apple II and II Plus 48k disk systems. And at under $100, DMS is also easy to afford.

One demonstration will convince you how easy computerized record keeping is. Ask your Personal Software dealer to show you. To locate your nearest dealer, contact Personal Software, Inc., (408) 745-7841, 592 Weddell Dr., Sunnyvale, CA 94086.

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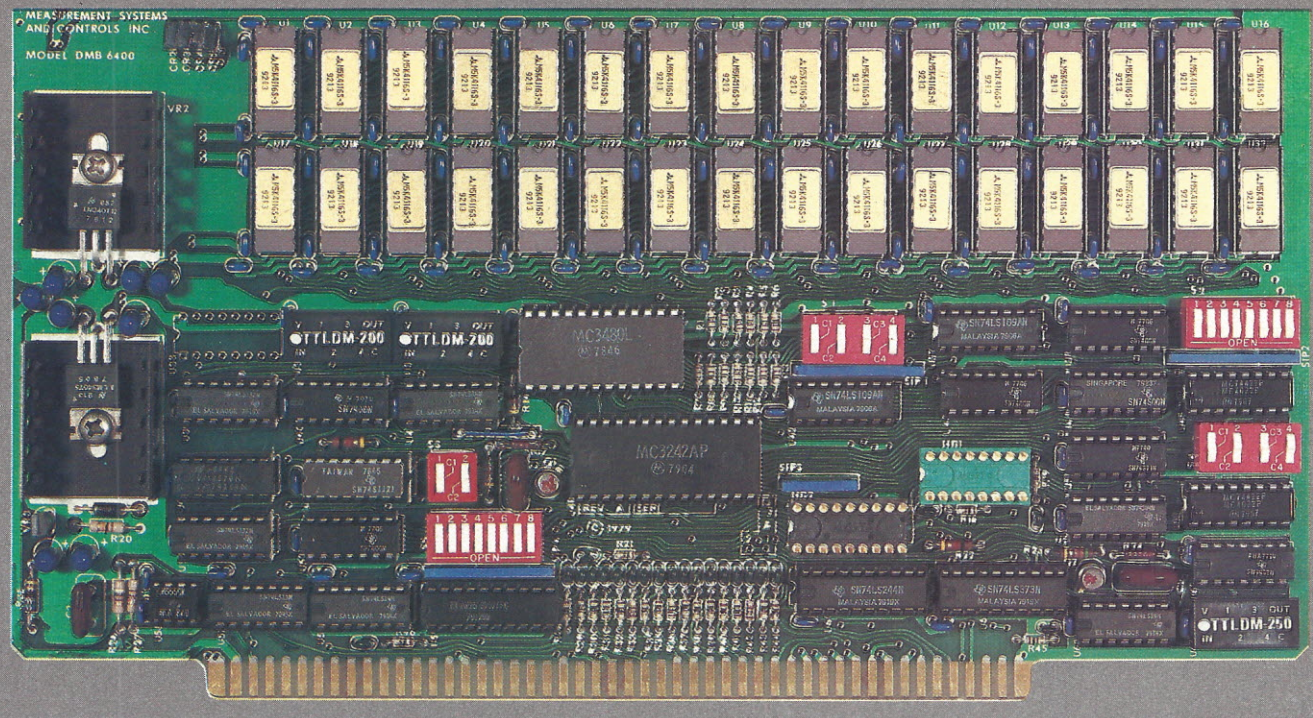
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INTERFACE AGE™

COMING IN JUNE

INTERFACE AGE's systems editor Tom Fox takes a hard-nosed look at the major micro-based systems on the market, and you'll get his unflinching critique on the various merits and demerits of hardware, software and disk drives.

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Introductory prices. Trade-in allowances for upgrade to higher levels.

PEARL Level 1	For Personal Computing	$ 90	
PEARL Level 2	The Business Assistant	$ 200	
PEARL Level 3	For Software Developers	$ 400	May 1980
PEARL Level 4	For Turnkey Systems Developers	$ 800	June 1980

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At Verbatim, the whole message is quality. We specialize in digital data recording media and have become the world leader by setting the standards for flawless, dropout-free magnetic media. Every size, every format, and available everywhere. Order them from your computer supplies dealer.
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1215 Genève 15
Switzerland
Telephone: 41(22) 34-90-55
Telex: 22647 ITGE CH.

CIRCLE INQUIRY NO. 91



Without an Eaton LRC Printer you

Get serious



are just playing computer games.

for only $389.

Introducing the New Eaton LRC 7000+ Dot-Matrix Impact Printer.

No matter what type of personal computer you now have, or are thinking of buying —

Apple	**Interact**
Cromemco	**Commodore Pet**
TRS-80	**Northstar**
TI	**Ohio Scientific**
Exidy	**and others**

— the new Eaton LRC 7000+ dot-matrix impact printer will quickly interface and be printing in a matter of seconds. You'll immediately have hard copy capabilities that will allow you to go beyond computer games and get down to serious business.

An Invaluable Addition

Adding a printer increases the practicality and usefulness of your personal computer dramatically. You'll be able to perform all sorts of bookkeeping and accounting functions — from balancing your personal checkbook to monitoring your company's inventory — and you'll have a permanent copy for your records. You'll find that whether you're controlling your family's budget, recording your program listing, plotting the



growth of a stock in the market, or any of the other thousands of analytical functions your computer can perform, a quality printer is simply invaluable. But you'll want to be sure to pick the right printer for your system.

The Right Printer



The Eaton LRC 7000+ is designed specifically for personal computers. Its plug-in simplicity makes it remarkably easy to interface with any computer. Its simple design features the fewest possible moving parts, making it virtually maintenance free. Unlike many other printers, the 7000+ can print on any type of roll paper, eliminating the hassle and added expense of purchasing a special, treated paper. Its rugged case is tough enough for industrial environments, yet attractive enough for home or office use. And most importantly, it offers the high performance and features you demand in a quality printer.

Super Performance

The 7000+ features uni-directional printing with a line speed of 1.25 lines per second. It accepts any single or two-ply paper roll from 3/4 inch to 3-7/8 inches wide, and prints a 3-1/3 inch line. Capacity is adjustable and can be 40 columns at 12 characters to the inch using the single width font; or 20 columns at 6 characters to the inch using the double-wide font. An available option allows the unit to print 64 columns at the single width setting, and 32 columns using a double width font.

An Unbeatable Price

The real beauty of the new 7000+ is the fact that you can't buy another printer that offers you all these features at anywhere near the price. Eaton LRC's 7000+ has a suggested retail price of $389.00 and comes with a 90-day factory warranty.

Specify Eaton LRC

Whether you're looking for a quality printer to add to your existing computer, or are about to buy a complete system, don't settle for less than an Eaton LRC printer. Stop by your local Computerland store or contact Quest Electronics, 2322 Walsh Avenue, Santa Clara, CA 95051, (408) 988-1640 or Sigma International, Inc., P.O. Box 1118, Scottsdale, AZ 85252, (602) 994-3436 for more information. Once you've seen the new 7000+, you won't settle for anything less. LRC, an EATON company, Riverton, Wyoming 82501, (307) 856-4821.

Master distributor inquiries welcome. Contact your nearest LRC Regional Sales Office: Northeastern office, One Lakeside Office Park, Wakefield, MA 01880, (617) 245-2730; Southeastern office, 29 Delmont Drive Northeast, Atlanta, GA 30305, (404) 231-4105; Western office, 510 Lawrence Expressway, Suite 210, Sunnyvale, CA 94086, (408) 245-1590.

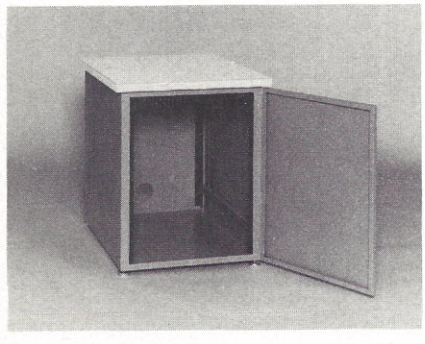
CIRCLE INQUIRY NO. 23

LRC

an EATON company

DESKS AND STUFF





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CIRCLE INQUIRY NO. 12

LETTERS TO THE EDITOR

INPUT ON TRS-80

I have been following Bob Albrecht's column closely as I have been weaning myself off calculators and onto the TRS-80. His graphing episode in particular was excellent. What is so very nice about these columns is the "try this and see what happens" approach which I find exactly the right kind of start because it encourages you to modify for your own purposes. Just great!

I am much impressed with the TRS-80. What scares me is the trap set by the easy "sophistication" of this equipment which entices many teachers away from mathematics and into CAI, games and alphabetizing. I feel that we need to offer some more appropriate avenues to use this fine tool within math.

None of that concern is meant to take away at all from your delightful work.

Gerald R. Rising
State University of New York
at Buffalo

SOFTWARE SECURITY

I refer to David Ahl's December letter about software piracy in this space. No software publisher need feel helpless about piracy any longer.

Historically, author-programmers have resisted writing in anti-dump/anti-save routines, because direct cassette-to-cassette copies could be made without entering the computer.

But this kind of leap-frogging with cassette or disk can now be made impossible or incredibly difficult. When a software product is duplicated at Cook Labs, a newly developed MIP technique (magnetic interference pattern) can be laid on the surface along with the program or data. The MIP does not interface with loadability, however.

Thus, if 'anti-dump' is written into the code, the software publisher is very secure.

However, to address David Ahl's complaint more directly: the MIP procedure will not succeed in improving any pirate's ethics. Like the speed of light, the statistical veniality of man is predictably constant.

Emory Cook
Norwalk, CT

EDUCATOR WANTS INFO

Recently a group of mathematics teachers gathered and your group/company was mentioned as a reference for calculator related materials. The teachers in our school and district are interested in the classroom use of calculators and would like assistance in this new concept of learning.

N. Reifferscheid, Vice Principal
St. Augustine School
P.O. Box 1810, Humboldt
Sask., Canada S0K 2A0

MODIFICATION TO COMPUTER SYSTEM

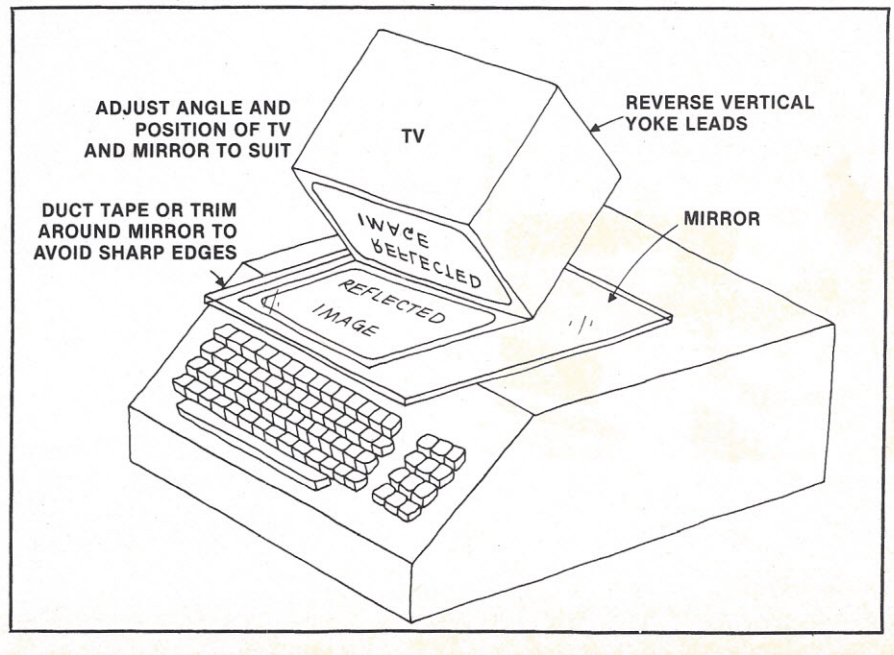
I made a simple modification to my computer system that turned out so well, I thought you might want to pass it on. I much prefer to type on a typewriter rather than a terminal because the letters appear right above my fingers. I don't have to look up and down to see what I've written and find characters typed which I didn't touch.

I have a SOL 20 and decided to mount my 9" TV down inside the chassis where it belongs. Naturally this would require a bit of slashing and burning, sawing, etc.

The simple solution was to put the image of the TV screen down inside the SOL rather than the TV itself. A piece of 8" x 10" mirror, a couple of brackets and reversing the vertical yoke leads did the trick.

The system is much easier to use either sitting or standing. You can juggle the mirror and TV angle to suit your own posture and system. I heartily recommend it.

Howard Barney
Los Altos Hills, CA



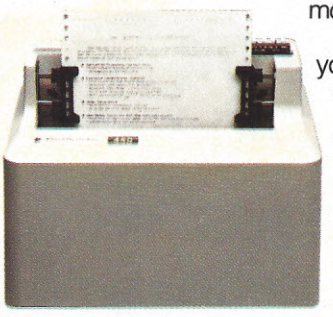
Grrraphics.

The Paper Tiger™ puts more bite into everything you do.

The Paper Tiger strikes again. With a DotPlot™ graphics option that lets you make the most of your Apple II, TRS 80, or other personal computer.

With DotPlot and available software drivers, you can print screen graphics, draw illustrations, write block letters, plot charts. And DotPlot includes an expanded, 2K-byte buffer.

That's not all. Every Paper Tiger gives you 8 software-selectable character sizes. 80 and 132 column formats. Multi-part business forms handling. Forms control. Reliable stepper-motor paper drive. Adjustable width tractor feed. Continuous duty cycle operation. Plus lots more.



The Paper Tiger costs only $995. The DotPlot option only $99 more. But don't let these low prices fool you. Because the Paper Tiger is rugged enough to stand up to the most demanding printer-plotter requirements.

For the name of the Paper Tiger dealer nearest you, call toll-free 1-800-343-6412 (except Massachusetts, Alaska, and Hawaii).

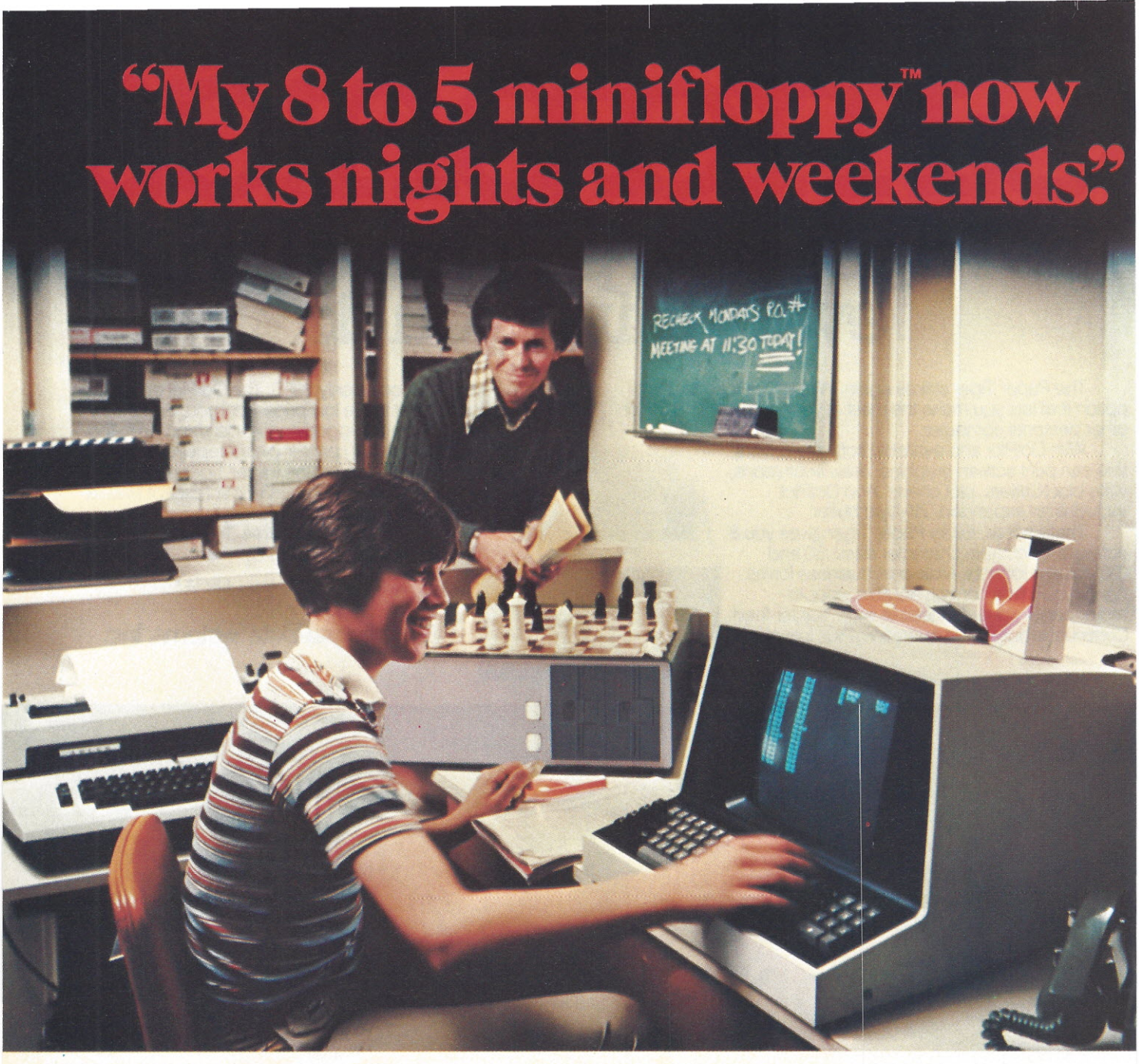
Integral Data Systems, 14 Tech Circle, Natick, MA 01760. (617) 237-7610.

CIRCLE INQUIRY NO. 38

Integral Data Systems, Inc.



"My 8 to 5 minifloppy™ now works nights and weekends."



"I own a fast-growing business and before I bought my computer system I put in a lot of late hours keeping up with my accounting and inventory control. Now the computer does my number crunching quickly, so I have time after hours to have some fun with the system. My son and I started out playing Star Trek on the system, and now we're learning to play chess.

"When I was shopping around for my system, the guys in the computer stores demonstrated all the unique features of the minifloppy. I've got to admit that at first I didn't really understand all the technical details. But now that I use the system every day, I really appreciate the minifloppy's fast random access and data transfer. I like the reliability, too.

"I'm glad I went with Shugart drives. Look, when you lay out your own money for a system, you want dependable performance and good value. Do what I did. Ask for the system with the minifloppy."

If it isn't Shugart, it isn't minifloppy.

Shugart

435 Oakmead Parkway, Sunnyvale, California 94086

See opposite page for list of manufacturers featuring Shugart's minifloppy in their systems.

TM minifloppy is a registered trademark of Shugart Associates

SCHOOL SEEKS HELP

Our Business Education Department is looking into the use of microcomputers.

We are very concerned about the availability of cassettes and software. Specifically we seek cassettes in our subject areas on the high school level. Are there cassettes available for students of bookkeeping, marketing, advertising, law, economics, business math, business machines, small business problems, general business problems, and other related topics?

In order for us to make an intelligent decision as to which computer should be purchased, we are attempting to first ascertain the certainty of software. We make no pretense of having any expertise in this field, and would appreciate any assistance and advice.

Phillip Lashinsky, Chairman
Business Education Dept.
Hendrick Hudson High School
Montrose, NY 10548

ELECTRONIC MAILBAG

Here are reprints of the first-ever letters sent to us by subscribers hooked into The Source, the home/business time-sharing service open to anyone with a terminal and a telephone. While an incidental start, these letters symbolize a computer communications blitz paralleling the advent of television.

Thu 31-Jan-80

Ref. your mention of electronic mail and uses in March 1980.

We have used The Source to develop a program called DATA CAPTURE for the Apple II. It will 'capture' any data that appears on the screen of your CRT including CHAT, MAIL or any database. It will transmit data to any other system using the S)end command. It will also transmit or receive programs from another Apple computer.

Another use of The Source is contact with our subscribers and customers. We write the newsletter for Apple II owners and quite a number of them are using the system.

George McClelland
Southeastern Software
TCA098

Glad to see that you are on The Source. The only thing I use The Source for is to send mail to other users. I have an Apple II and find that it is cheaper than using The Source for compute power and that my own machine has a much, much better response time.

The only fault that I found with your last report on The Source was that Pascal is not available. I joined in order to use Pascal and when I made inquiries about it, I was told that Pascal was a year off. That was a real disappointment. You will notice that they have finally dropped Pascal from their ads and that Micro-Net has made a big deal about the fact that all their software is available now.

Hope to hear from you soon.

Ned W. Rhodes
TCA193

Fri 1-Feb-80

In response to "Electronic Mail" in Editor's Notebook, I must remark that INTERFACE AGE seems to be leading the field again. The use of The Source as an electronic mail system for communications between magazines and subscribers seem endless.

Some uses that come to mind are uploading text and programs for publication. Listings of BASIC and assembly language programs, when sent directly from a source disk, should be flawless. When downloaded at your end, testing prior to publication could be done in a painless and almost instantaneous fashion. I would also like to see the system used for communications between subscribers and various magazine departments. With a directory published in the magazine, correspondence could be properly addressed by the user to, say, the subscription department, hardware, software, etc., editors.

I hope that you will continue in your efforts to develop The Source as a viable alternative to the post office. It's fast, accurate, cheap, and ecologically sound. Keep up the good work!

Mike Kirsch, San Francisco, CA
TCB867

Fri 1-Feb-80

Hi, progressive publisher. (You're certainly in the vanguard!)

First, a concern for what will be to some respondents an incomplete address (i.e., anyone on a system other than yours: SYS#11 will receive a "NOT FOUND" message). I am on system #10. The crossover between systems is possible simply by prefixing the mail command with the system number (Ex: □11 MAIL TCD073). However, replies should go through automatically without your having to specify my different system number (10).

You mentioned that you are "expanding into some other networks." Could you provide me a list of others?

My company will shortly produce what we regard as the first truly "executive" terminal . . .built into a hardwood console with Tambour door, etc. This was designed to suit the exacting requirements of one of McGraw-Hill's pub divisions who plan to provide subscribers with an electronic database option to their regular publication.

We would love to "interface" with other publishers and services who may wish to coventure their marketing objectives with the utilization of our executive terminal (which we have fondly dubbed: "Excalibur").

Best Wishes
Jim Blackman, Oak Brook, IL
TCA241

Wed 30-Jan-80

Hello, I'm Stanley Sutton, and I subscribe to INTERFACE AGE. I have a TRS-80, and mostly use The Source for the mail service and for communicating to other TRS-80 owners via The Source-80 Users Group.

Stanley Sutton
TCB233

Look for Shugart drives in personal computer systems made by these companies.

Altos Computer Systems
2360 Bering Drive
San Jose, CA 95131

Apple Computer
10260 Bandley Drive
Cupertino, CA 95014

Commodore Business Machines, Inc.
3330 Scott Boulevard
Santa Clara, CA 95051

Digital Microsystems Inc.
4448 Piedmont Avenue
Oakland, CA 94611

Industrial Micro Systems
628 N. Eckhoff
Orange, CA 92668

Micromation Inc.
1620 Montgomery Street
San Francisco, CA 94111

Morrow Designs Inc.
Thinker Toys
5221 Central Avenue
Richmond, CA 94804

North Star Computers Inc.
1440 Fourth Street
Berkeley, CA 94710

Polymorphic Systems
460 Ward Drive
Santa Barbara, CA 93111

Tano Corporation
4301 Poche Court West
New Orleans, LA 70129

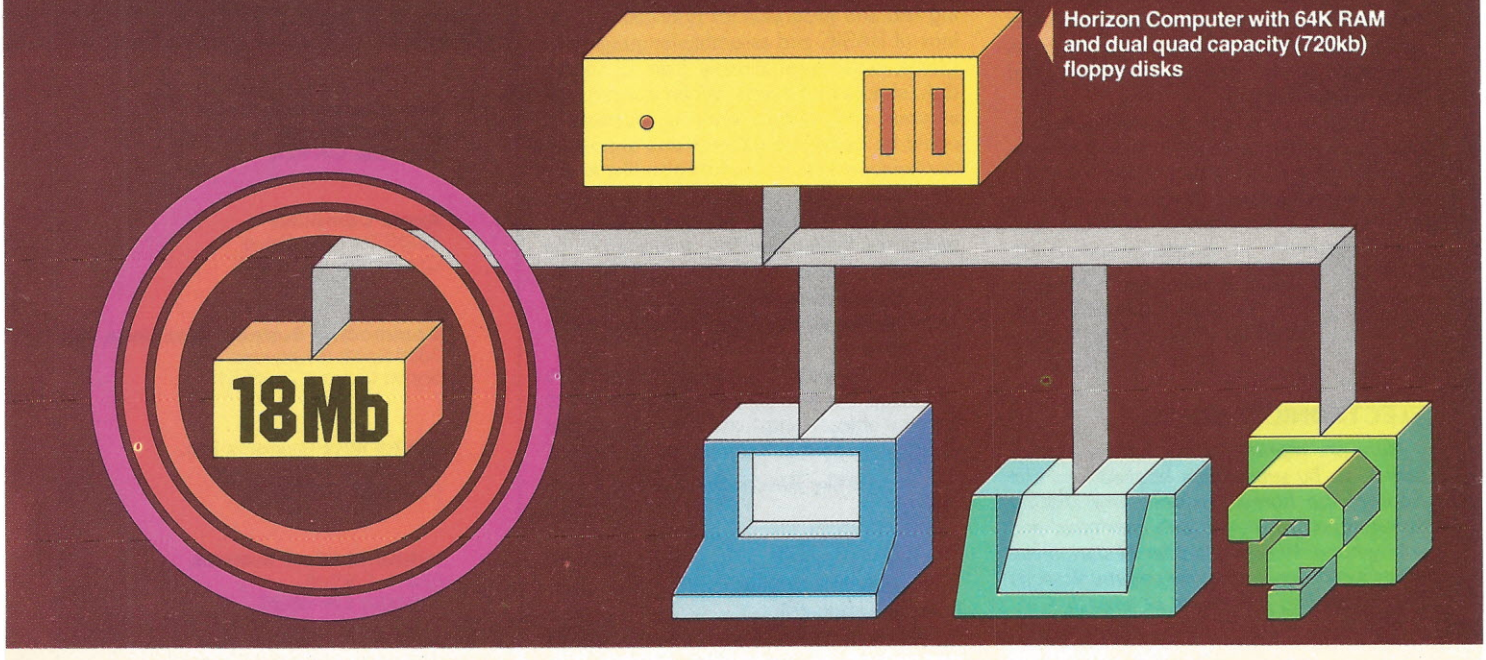
Technico Inc.
9051 Red Branch Road
Columbia, MD 21045

Texas Electronic Instruments
5075 S. Loop East
Houston, TX 77033

Vista Computer Company
1401 E. Borchard
Santa Ana, CA 92705

Shugart

New on the North Star Horizon:
18Mb Hard Disk Drive!



Up to four 18Mb Winchester-type hard disk drives

Display terminal

Letter-quality or dot matrix printer

Horizon I/O flexibility allows expansion to meet your needs

Unsurpassed Performance and Capacity!

North Star now gives you hard disk capacity and processing performance never before possible at such a low price! Horizon is a proven, reliable, affordable computer system with unique hardware and software. Now the Horizon's capabilities are expanded to meet your growing system requirements. In addition to hard disk performance, the Horizon has I/O versatility and an optional hardware floating point board for high-performance number crunching. The North Star large disk is a Century Data Marksman, a Winchester-type drive that holds 18 million bytes of formatted data. The North Star controller interfaces the drive(s) to the Horizon and takes full advantage of the high-performance characteristics of the drive. Our hard disk operating system implements a powerful file system as well as backup and recovery on floppy diskette.

Software Is The Key!

The Horizon's success to date has been built on the quality of its system software (BASIC, DOS, PASCAL) and the very broad range and availability of application software. This reputation continues with our new hard disk system. Existing software is upward compatible for use with the hard disk system. And, with the dramatic increase in on-line storage and speed, there will be a continually expanding library of readily available application software. For more information, see your North Star dealer!

HORIZON-HD-18
Horizon computer with 64K RAM, 2 quad capacity mini drives and one HDS-18 hard disk drive **$9329**

HDS-18
Additional 18Mb hard disk drive for expansion of Horizon HD-18, or your present Horizon **$4999**

SYS-1N
Complete Horizon HD-18 plus 80 x 24 display terminal and NEC Spinwriter printer **$13,239**

SYS-1A
Complete Horizon HD-18 with 80 x 24 display terminal and Anadex printer **$11,319**

NorthStar

North Star Computers, Inc.
1440 Fourth St.
Berkeley, CA 94710
(415) 527-6950 TWX/Telex 910-366-7001

CIRCLE INQUIRY NO. 61

UPDATE

COMPUTER/LAW BOOK

The Center for Computer/Law has published its first annual Computer Law Bibliography. Edited by Michael D. Scott, editor-in-chief of the Computer/Law Journal, and David S. Yen, director of the law library at Southwestern University School of Law in Los Angeles, the volume organizes citations under topical headings, from system design and system procurement to privacy, taxation and international law.

The bibliography contains over 2,000 entries from over 300 publications in law, computers, banking, auditing, business and government, compiled from bibliographies in the first volume of Computer/Law Journal.

For further information contact Michael D. Scott, Center for Computer/Law, 530 W. Sixth St., Los Angeles, CA 90014.

CALL FOR MEDICAL PAPERS

The 13th Annual Hawaii International Conference on Systems Sciences, scheduled for 8-9 Jan 1981 in Honolulu, is soliciting papers from researchers and practitioners in the medical information processing field. Suggested topics are: medical risk analysis; ambulatory computer systems; computers and the handicapped; evolutionary changes in hospital information processing; computer-based instrumentation; human/machine interface for medical data processing; medical diagnosis and decision criteria by computer; database systems and applications for health care; international involvement in medical data; decision support systems for medical information processing; medical applications of word processing; impact of technology on medical information processing.

Papers should be typewritten, double-spaced, 15-25 pages. Authors accepted will be notified by 15 Sep 1980. Final versions of papers accepted for publication are due 12 Nov 1980. The conference is sponsored by the Department of Decision Sciences, the Department of Information and Computer Science, and the Department of Electrical Engineering at the University of Southwestern Louisiana.

For details contact Dr. T. Walker or Dr. B. Schriver, Computer Science Dept., University of Southwestern Louisiana, P.O. Box 44330, Lafayette, LA 70504 or Dr. Ralph R. Grams, College of Medicine, Dept. of Pathology, University of Florida, Box J-275, Gainesville, FL 32610.

"HOME-ORDER" SHOPPING ON THE HORIZON

Although "pushbutton" or "armchair" shopping has failed to make a breakthrough in the past, a study by Link, a consulting firm specializing in electronic distribution information, says it's on tap for the '80s. It has already uncovered:

- A department store chain in Minnesota that installed terminals in its stores to allow customers to register Christmas and bridal gifts, and look up gift information for friends and family.
- A mail order company that displays its catalog on a special TV channel, permitting viewers to order by pushing buttons on a special console in their homes.
- A low-cost travel service available nationwide to plan trips, make reservations and buy tickets instantly through home terminals.

Changing attitudes among both businesses and consumers make the steady growth of home shopping and transactional services (e.g. banking) likely throughout the 1980s. Viewdata and other interactive media, such as two-way cable TV, will dramatically alter the way goods and services are promoted and sold in the 1980s, according to the study.

Because these media are two-way, low-cost and easy-to-use, they could become the most significant development in communications since television. The study predicts that the current era of intense experimentation with transactional applications will be followed by a period of widespread implementation of services between 1985 and 1990.

Technological advances make the equipment inexpensive and friendly enough for the mass market. Significant financial commitments by prominent organizations, such as AT&T, GTE and the Knight-Ridder newspapers, are funding rapid testing and implementation of viewdata systems in the US; in Europe, government telecommunications agencies are doing the same in nearly every country.

Link found that the growth of viewdata systems coincides with a pressing need among direct marketers to target segments more efficiently, particularly and postal and printing costs skyrocket. Viewdata offers consumers convenience as well as savings in time, money and energy — factors likely to be crucial in consumer acceptance of these new interactive media.

FINANCIAL, DP SALARIES REACH RECORD LEVELS

The 1980 earnings for financial executives, accountants and data processing personnel are at all time highs, according to a study by Robert Half, Inc., New York, NY. The analysis, based on thousands of position requests received from employers throughout the nation, indicates that financial starting salaries are up an average of 4.9% over last year; data processing positions increased 8.1%.

Highlights from the 1980 study reveal that in the DP field operation managers at large installations can expect to start in the $22,000-$29,500 range; up 8.4% over 1979. Senior programmers at medium-size installations are being paid $19,000-$23,000; a 3.7% gain. Systems analysts at small installations earn $19,000-$23,500, a 10% increase. Data processing managers at small installations can start from $22,000 to $29,000; a gain of 8.5%. Large installations are offering programmers, with up to one year of experience, $14,500-$17,500; up 10.3%



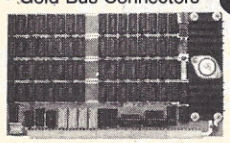
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32K STATIC RAM BOARD

- SS50C Extended Addressing (can be disabled)
- 4 separate 8K blocks
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- Write Protect
- Fully Socketed for 32K
- Gold Bus Connectors

NEW!



16K . . $328.12
24K . . $438.14
32K . . $548.15

16 & 24K Versions are socketed for 32K and require only additional 2114S for expansion.

All GIMIX Memory Boards are assembled, burned-in, and tested at 2MHz.

FACTORY PRIME STATIC RAMS

2114L 450 ns . . . **$5.90** 200 ns $6.90
4044 450 ns **$5.90** 250 ns $6.90
Add $5.00 Handling on Orders Under $200.00

THE UNIQUE GIMIX 80 x 24 VIDEO BOARD

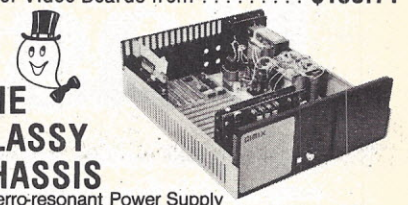
- ★ Upper and Lower Case with Descenders
- ★ Contiguous 8x10 Character Cells
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- ★ X-Y Addressable Hardware Cursor

It is the ***ONLY*** **Video Board** that gives you **Software Control** of:

- A programmable RAM Character Generator plus 2 EPROM Character Generators (128 char. ea.).
- Selecting 256 Displayable Characters from 384 available.
- Normal or inverse video, full or reduced intensity, or combinations of these by ***both*** ASCII Code and Bit 8.
- GHOSTability — multiple boards at the same address.

Fully decoded, occupies only 2K of address space
Fully socketed — Gold bus connectors.
Assembled, Burned-in, and Tested at 2MHz.

Deluxe Version **$458.76**
Without RAM Character Generator . . **$398.24**
Other Video Boards from **$198.71**



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- Ferro-resonant Power Supply
- Heavyweight Aluminum Cabinet with fan and provisions for two 5" disk drives.
- 6800/6809 Mother Board, fifteen 50 pin and 8 DIP-switch addressable 30 pin slots — Gold Plated Pins. Fully decoded

With Baud Rate Generator on Mother Board . . . **$828.19**

32K SYSTEM *Incomparable Features at a Comparable Price!* **$1,594.59**
Includes: Chassis, 6800 CPU, 32K RAM Board, Choice of I/O Card.

16K Version of above $1,374.49

Phone, write, or see your dealer for details and prices on our broad range of Boards and Systems for the SS50/SS50C bus and our AC Power Control Products for all computers.

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CIRCLE INQUIRY NO. 31

Half pointed out that these figures are national averages; geographic variances must be applied to all data processing salaries of $50,000 or less.

For example, salaries in Connecticut, Illinois, Michigan and Nevada are 5% higher than the national average. In North Carolina, Montana, Maine, West Virginia and Mississippi, they are 8-10% lower.

UNTRAINED COMPUTER PERSONNEL ADD TO ECONOMIC SLUMP

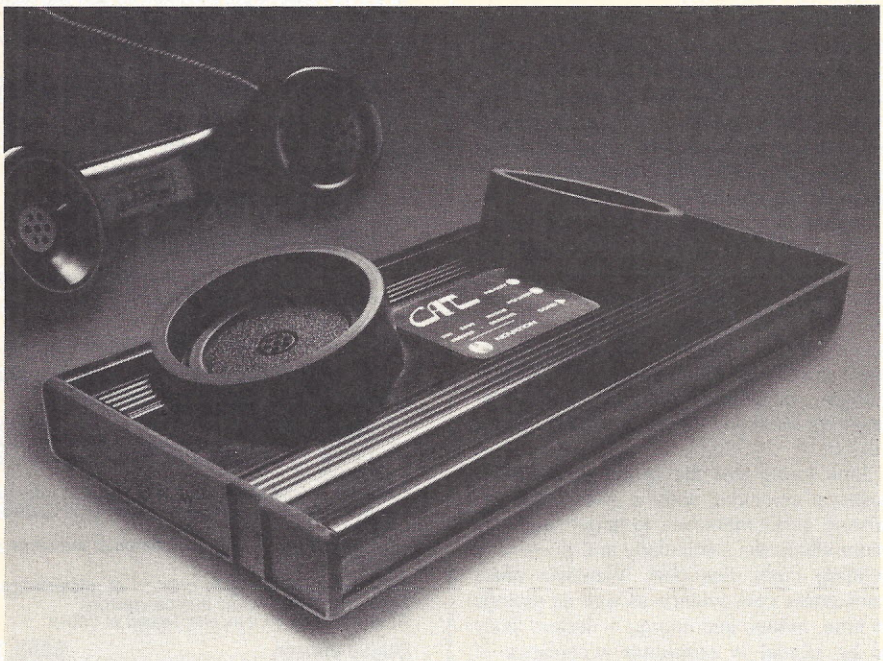
America's productivity lag will drop still further unless more people are trained and kept abreast of new developments in computer systems. At least that is the view of R.E. King, president of Deltak, Inc. Increased use of computers can help solve the nation's problem, according to King, "but the full potential of the computer won't be realized unless we have enough trained people to properly manage and operate them."

"Our technology could literally outstrip our ability to utilize it. . .and we would have to backtrack. . .a step that certainly would hurt. As we rely more heavily on computers, this situation will get worse unless more companies are willing to expend the management support, time and money to train the people needed to make the most effective use of their computer systems."

"Universities are not graduating enough trained people. And, computer technology changes so rapidly that even university-trained people find themselves outdated in a very short time.

"This shortfall is compounded by a shortage of qualified instructors to meet the demand for educating people for computer management and operation," King stated.

His solution: ". . .take the top educators in the field, capture their expertise on video tape and conveniently bring them into the training rooms of any company using computers. Tapes can be viewed as often as necessary to ensure that the material is properly learned, or to provide technical reviews after the initial training has been completed.



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CIRCLE INQUIRY NO. 62

PERTEC BOUGHT BY EUROPEAN UNIT

Triumph Adler Inc., a subsidiary of the giant West German conglomerate Triumph Werke Nuernberg AG, in a bid to gain a stronger foothold in the U.S., purchased Pertec Computer Corp., Los Angeles.

A company spokesman said that the firm will become a wholly-owned subsidiary of Triumph Adler Inc., which acquired more than 97% of the outstanding common stock of Pertec. Remaining outstanding shares were converted into a right to receive $16.50 per share and ceased to be voting stock of PCC.

Triumph Adler Inc. is a marketer of office automation equipment. Its headquarters will be PCC's corporate offices in Los Angeles; however, other Triumph Adler subsidiaries — Royal Business Machines and Adler-Royal Business Machines — retain their executive, administrative and marketing headquarters in Hartford, CT and Union, NJ.

Triumph Adler is 54% owned by Volkswagen, 26% by Diehl Data Systems and 19% by Litton Industries of Beverly Hills.

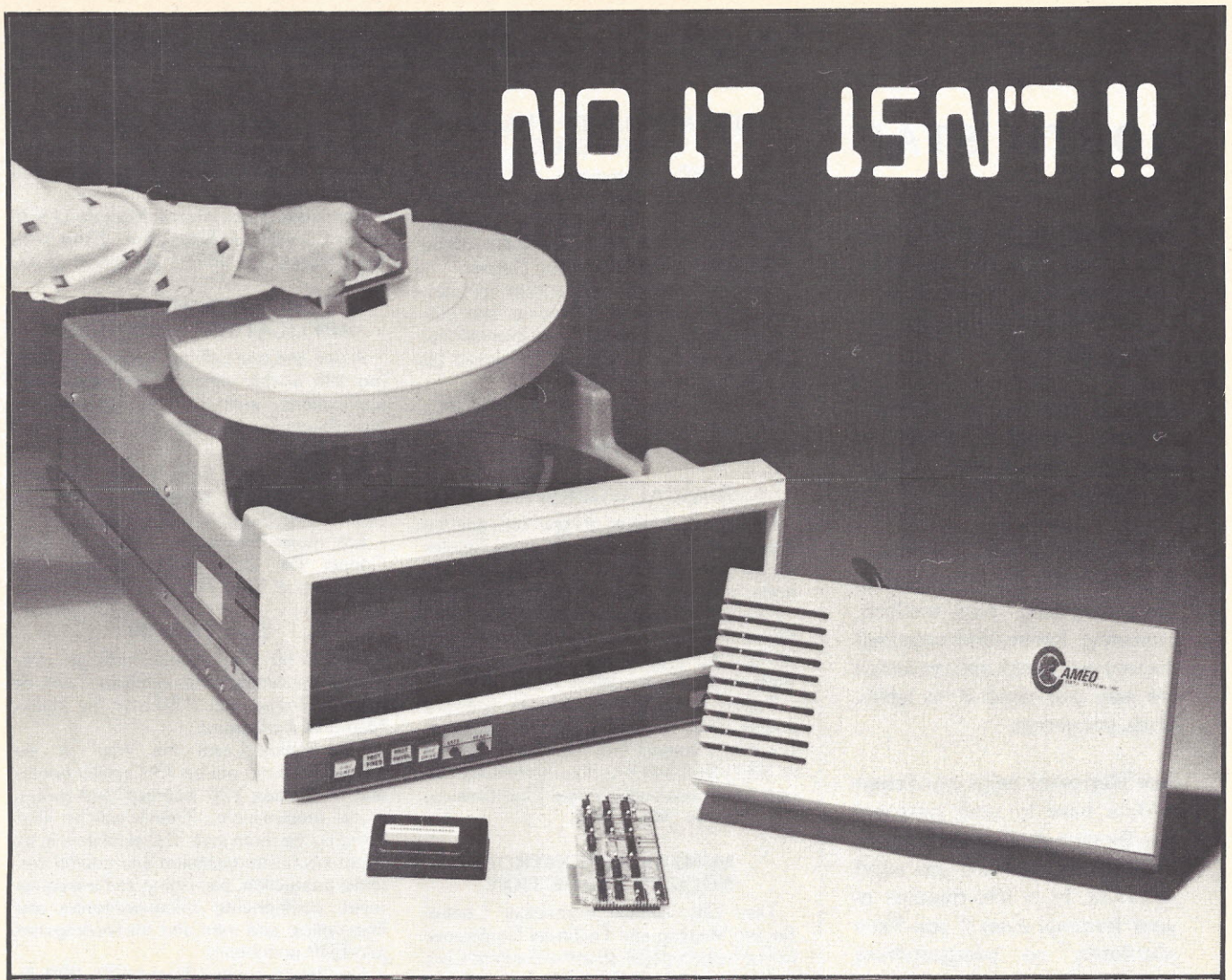
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ACE REPORTER

CIRCLE INQUIRY NO. 67

CALENDAR

INTERNATIONAL DP TRAINING CONFERENCE

The 1980 International DP Training Conference has been scheduled for April 23-25 at the Hyatt Regency in Chicago. The theme for this 5th annual event will be "The 1980s: The Information Decade."

The conference is a symposium for internationally prominent DP experts and corporate training executives. The International DP Training Conference is sponsored by Deltak, Inc., Oak Brook, IL.

For more details contact Deltak, Inc., 1220 Kensington Rd., Oak Brook, IL 60521, (312) 920-0700, Sharon Trube.

PASCAL WORKSHOP

Polytechnic Institute of New York and the Institute for Advanced Professional Studies are presenting an intensive seminar for engineers, programmers and technical managers.

"Pascal Programming for Mini and Microcomputers" will be held on April 25-26 and May 1-3 at the Polytechnic Westchester Center, White Plains, NY.

Tuition is $600 and includes extensive course notes, text, and evening reception. For details contact Prof. Donald D. French at (617) 964-1412 or the Institute for Advanced Professional Studies, One Gateway Cir., Newton, MA 02158.

NUMERICAL CONTROL SOCIETY EXPOSITION

The 17th Annual Numerical Control Society Meeting and Technical Conference will be held April 27-30 at the Hartford Civic Center in Hartford, Connecticut.

There will be technical sessions with topics including Computer Aided Design Applications, Computer Aided Manufacturing Applications, Numerical Control, Database Structure and Management and educational programs.

Interested parties can contact Exhibits Coordinator, Numerical Control Society at 519-520 Zenith Dr., Glenview, IL 60025, (312) 297-5010.

COMPUTERIZED OFFICE EQUIPMENT EXPO

The Computerized Office Equipment Expo-Midwest will be held at the O'Hare Exposition Center in Rosemont, Illinois (suburban Chicago) April 30-May 2.

The Exposition will feature the latest technological developments in computers, word processors, copiers/duplicators, telephone systems, and other automated business equipment.

For more information contact Industrial & Scientific Conference Management, Inc., 222 W. Adams St., Chicago, IL 60606, (312) 263-4866.

MICRO EXPO '80

The fifth Micro Expo '80 will be held May 6-8 at the Centre International de Paris in Paris, France. Micro Expo '80 is the largest show in Europe on microcomputers and personal computing.

The four major themes of this year's technical program are Personal Computing, New Products, Industrial Applications and Communications.

For details contact Robert Maraziti, U.S.A. Show Coordinator, Sybex, Inc., 2344 Sixth St., Berkeley, CA 94710, (415) 848-8233.

MICROPROCESSOR APPLICATIONS SYMPOSIUM

A one and one-half day symposium dealing with a wide variety of microprocessor applications entitled "Microprocessors: New Directions for Mankind" will be held May 13-15.

The symposium, to be held in Albuquerque, New Mexico, is part of the Ideas in Science and Electronics (ISE 80) Show.

For more information contact J. Arlin Cooper, Div. 2331, Sandia Laboratories, Albuquerque, NM 87185, (505) 264-6550.

ELECTRO/80

Electro/80, the high-technology electronics convention and exhibition, will be held in Boston May 13-15 at the Hynes Memorial Auditorium.

"Electronics Leads the Way" is the theme. Featured will be 730 exhibit booths and more than 120 technical and professional presentations. Trends will be illustrated by the more than 350 exhibitors in instruments/instrumentation and control systems; production, packaging and test equipment; components; microelectronics and fiber-optics; and mini and microcomputers and EDP peripherals.

For details contact Electro/80, 999 N. Sepulveda Blvd., El Segundo, CA 90245, (213) 772-2965.

MICROS IN BUSINESS SEMINAR

The College of Business Administration of Butler University will conduct its second annual "Microcomputers in Business and the Professions" seminar on May 14.

The primary objective of the one-day seminar is to give the participant the information necessary to intelligently select a microcomputer system that will meet their particular needs. It is designed for individuals with no previous computer experience.

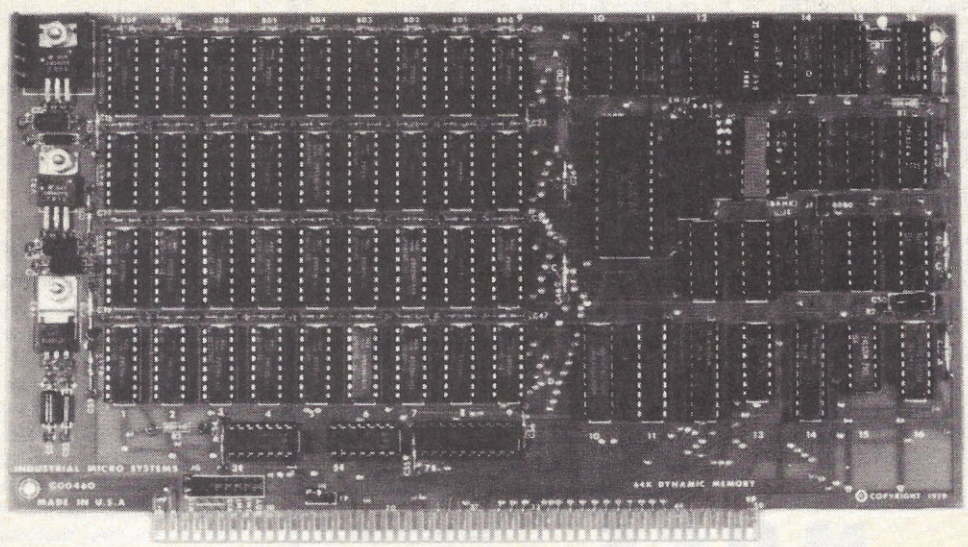
For more information contact Dr. H. Raymond Swensen, Dean, College of Business Administration, Butler University, Indianapolis, IN 46208, (317) 283-9221.

NCC 1980

The 1980 National Computer Conference, sponsored by the American Federation of Processing Societies, Inc., The Association for Computing Machinery, the Data Processing Management Association, the IEEE Computer Society and the Society for Computer Simulation, will be held at the Anaheim Convention Center in Anaheim, California.

The Conference will be held May 19-22. For more information contact Barmmer Elliott, Inc., Victor Cavallo, (203) 356-9411.

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CIRCLE INQUIRY NO. 79

CALENDAR Continued from Page 20

COMPUTER CAMP

This summer, youngsters can sign up for a week long camp in Moodus, Connecticut where the main activity will be computers.

During the week June 29-July 4 campers from ages 10-17 will enjoy small group instruction and mini and microcomputers for ample "hands-on" experience.

The camp is for kids of all levels of experience including no experience whatsoever. For more information contact Michael Zabinski, Computer Camp, Grand View Lodge, Box 22, Moodus, CT 06469, (203) 795-9069.

SILICON CONFERENCE

Invitations and a call for papers are being issued for the Third International Conference on Neutron Transmutation Doping of Silicon. The conference is being arranged by Topsil/Motorola, and will take place on August 27-29 in Copenhagen.

Topics for the conference include transmutation physics, radiation defects, irradiation techniques, material properties and specifications, device applications, new devices and new materials.

For details contact Motorola Inc., Semiconductor Group, P.O. Box 2953, Phoenix, AZ 85062.

MID-ATLANTIC COMPUTER SHOW

The Mid-Atlantic Personal and Business Computer Show will be held at Philadelphia Civic Center from September 25-28. Show hours are 11 a.m. through 9:30 p.m. September 25-27 and 11 a.m. to 6 p.m. September 28. General adult admission will be $5.

The show is produced by National Computer Shows (formerly Northeast Expositions). For details contact them at P.O. Box 678, Brookline Village, MA 02147, (617) 524-0000.

NEW JERSEY COMPUTER SHOW

The 1980 New Jersey Personal Computer Show and Fleamarket will be held September 27-28 at the Holiday Inn (North), at Newark International Airport (NJ Turnpike Exit 14).

The show will feature an indoor commercial exhibit area, a large outdoor fleamarket and user group meetings/forums on the TRS-80, PET, Apple, Heath and other popular systems.

For additional information write NJPCS, Kengore Corp., 9 James Ave., Kendall Park, NJ 08824.

DATES SET FOR PC '80

The Fifth Annual Personal Computing and Small Business Computer Show, PCC '80, will be held on October 9-12 at the Philadelphia Civic Center.

For more information contact John Dilks, Personal Computing '80, Route 1, Box 242, Ward Rd., Mays Landing, NJ 08330, (609) 653-1188.

BOOK REVIEWS

TRS-80 INTERFACING
By Jonathan A. Titus
Howard W. Sams & Co., Inc.
190 pages. $8.95

Review by Jerry Martin

The author states that the purpose of this book is to explain the signals available within the Radio Shack TRS-80 computer and to show how they can be used to control external devices utilizing Level II BASIC. The Level II was chosen because of its access to the I/O ports via the INP and OUT commands.

There are several major prerequisites needed to get the most out of this book. The first is a sound understanding of the Level II BASIC language. While only a small portion of the commands are used in the examples throughout the book, it would be very difficult to utilize the power of the interfacing techniques without a firm understanding of BASIC. Some background in digital electronics and internal computer architecture is necessary due to the many references to timing diagrams and logic circuits. Multiple references to IC chips and their associated block diagram schematics as well as function tables would soon confuse anyone who is unfamiliar with these topics. In addition it is necessary to assemble circuits from circuit schematics and be fairly handy with a soldering iron.

These requirements may seem a bit stiff for the novice, but it is generally wise to understand what is going on internally before trying to hook up an interface circuit. Several assembled interface circuits are on the market which do all the electronics for you; some of the software is available also. But these force the use of a specific port and allow a limited number of I/O signals.

TRS-80 Interfacing is divided into two sections. The first is a description of the TRS-80 computer and some of the interfacing circuitry needed. This description encompasses chapters one through four. Chapters five and six deal with a breadboard design and experiments that can be done using the breadboard. In addition there are five appendices, (A) Logic Functions, (B) Parts Required for the Experiments, (C) Z-80 Microprocessor Technical Data, (D) TRS-80 Interface Breadboard Parts and (E) Printed-Circuit Board Artwork.

The breadboard is a major portion of the book and I would consider it a necessity to understand the experiments presented in chapter six. Two companies are given who will supply all parts and the circuit board at the end of Appendix D. For those do-it-yourself folks, Appendix E has the PC artwork which must be enlarged before it can be used. The breadboard costs around $140 if you choose to order the parts and assemble it yourself.

On the whole I think *TRS-80 Interfacing* is an excellent way to learn the methods used to allow the TRS-80 to talk to the outside world. I would recommend *TRS-80 Interfacing* to those with a basic understanding of digital and computer electronics.□

SOFTWARE INTERPRETERS FOR MICROCOMPUTERS
By Thomas C. McIntire
John C. Wiley & Sons, Inc. $18.95

Review by Phil Hughes

Software Interpreters for Microcomputers presents an in-depth look at the implementation of interpreters. Although the design of a BASIC interpreter for an 8080-based system is the model for what is presented in the book, the concepts presented are not tied to any particular hardware.

This book is divided into five parts. Part one presents background information. This covers a comparison of interpreters with compilers, discussion of 4-, 8- and 16-bit microprocessors and comparisons of computer languages. The discussion of 4-, 8-and 16-bit micros is brief and a bit dated, but this is not important to the flow of the book.

Starting with part two we get to the meat of the book. The first chapter of this part addresses three possible forms of stored program code which can be used to drive interpreters. The following chapter then addresses the use of storage by the interpreter. This includes a discussion of what should be considered for allocation in ROM (firmware).

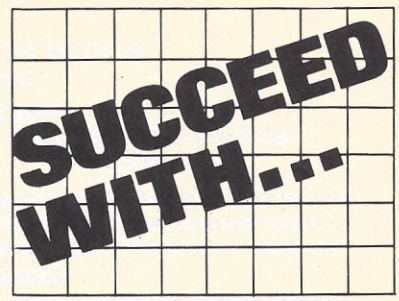
Using part two as a basis, part three addresses the actual design approach. Although the final design is for a BASIC interpreter for an 8080, the topics covered in these chapters are equally applicable to any other language and microprocessor. In fact, in the software taxonomy chapter, some COBOL statements creep into the discussion.

Using a top-down approach to design, the next chapter addresses the selection of the appropriate architecture for the interpreter. For example, whether the interpretation should take place as a prepass, at load time, during the source entry or at execution time is discussed. Next, the interfacing requirements between the interpreter and the operating system are explored.

Part four takes the ideas presented and tools that have been developed in the preceding chapters and applies them to the design of the 8080-based BASIC interpreter. The taxonomy, architecture and interfacing are addressed as they specifically apply to this example. Then a design template is developed for this example.

The final part of the book addresses optimization techniques. This part is divided into chapters on execution speed and memory utilization.

In summary, this book presents background and design methodologies for microprocessor-based interpreters and develops a specific example. For anyone who either wants to know in detail what makes an interpreter tick or plans to design their own interpreter, I would recommend reading this book.□



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CIRCLE INQUIRY NO. 92

COMPUTER GAMES FOR BUSINESSES, SCHOOLS AND HOMES

By J. Victor Nahigian and William S. Hodges
Winthrop Publishers, Inc.
157 pages. $10.95

Review by Jerry Martin

Two things new computer owners realize is that without programs the machine just sits there doing nothing, and that good programs take hours to design, write and debug. The desire to acquire a library of existing software increases as the question "what else can it do?" keeps arising.

One good source of software is a book containing many different programs. This book has 27 game-type program listings written to run on a PDP8/1 with 8K of memory. The BASIC on a PDP computer is very similar to Microsoft BASIC available on almost all of the popular microcomputers.

A description of the major variables is given which would aid in any modifications that might be made on a program. There is a sample run for each program so it can be seen what the game does. Almost all of the programs can be entered and run without any modification.

This type of book is probably the cheapest method of acquiring programs other than swapping with friends or writing them yourself. Most of the programs could be improved by utilizing the graphics capabilities of your microcomputer, thereby improving your knowledge, or frustration, in programming.□

THE COMPLETE HANDBOOK OF ROBOTICS

By Edward L. Safford Jr.
TAB, 358 pages. $7.95

Review by Joe Humphrey

Any person interested in the field of robotics should buy this book for his collection. While not quite a "complete handbook," it does give suggestions as to which direction to take.

The first eight chapters study the aspects of robot-mobility, sensory input, power sources, feedback, robot brains, and limb movement, with many illustrations and circuit diagrams included.

The knowledge gained from these chapters is used to build a robot platform which may be controlled either by remote switches or a microprocessor.

Other chapters look into such advanced topics as radio control and interfacing to a computer, robots already in existence and the future of robotics.

Although the author gives the impression that he is writing for the average reader, there are enough undefined terms to require some experience in electronics before reading the book. Overall, the book is a good one, with many useful hints and references.□

the Column

By E. Currie
Pertec Computer Corporation
P.O. Box 2505, Chatsworth, CA 91311

THE PROBLEMS OF AUTOMATING

The rapid advance of the microcomputer industry has resulted in a rich offering of low-cost business systems in the marketplace; some are available at a cost under $10,000. The standard configuration of 24x80 CRT, ten-key pad, full ASCII keyboard, dual floppies and printer is well-established. It will soon be complemented by fixed hard disks in the 10-40 megabyte range.

High-quality, high-performance printers have proved resistive to the dramatic cost reductions characterizing other hardware but it is likely that they, too, will follow suit.

As hardware costs have plummeted, audience enthusiasm has risen. The small business owner is exhibiting considerable interest in microcomputers because they can now effectively reduce time, and labor-intensive manual operations. As prospective users review the available offerings of computer hardware, they are finding many attractive alternatives which readily permit them entry into the realm of data processing.

In this otherwise blissful alliance of buyer and supplier, there is one significant glitch: the unavailability of workable, low-cost software. Both vendor and buyer have failed to adequately consider the costs and problems associated with this lack.

Manufacturers have concentrated almost entirely upon production of low-cost hardware systems in the erroneous belief that there exists a wealth of extensive, well-documented, easily maintained and comprehensive applications software. Now, with the dramatic advent of small business systems, both vendors and users are finding that this great wealth of alleged applications software is, in many respects, sadly lacking. Much of it is poorly documented and often consists of a mixture of high level language and assembly code.

Further, the bulk of available applications software is specific and not easily modified in the field. Invariably, changes are required to meet particular customer requirements, and often complications in other parts of the software result.

An equally misleading assumption made by manufacturer and customer alike is that current techniques will afford a simple solution to the expense associated with software development and maintenance.

While it is true that there now exists a number of microprocessor high-level languages such as BASIC, COBOL, FORTRAN and Pascal, many of the operating systems available are highly specialized to support particular types of system software. With the exception of CP/M, none of these operating systems has gained wide acceptance. Again, except for CP/M, there is no indication that any standardization is forthcoming in this area.

Manufacturers have been reluctant to enter the software realm because of the potential liabilities and inordinate support costs associated with such packages. Nonetheless, a variety of vendors offer programs such as General Ledger, Payroll, Accounts Receivable, Accounts Payable, Inventory Management, Attorney Time-Keeping and others.

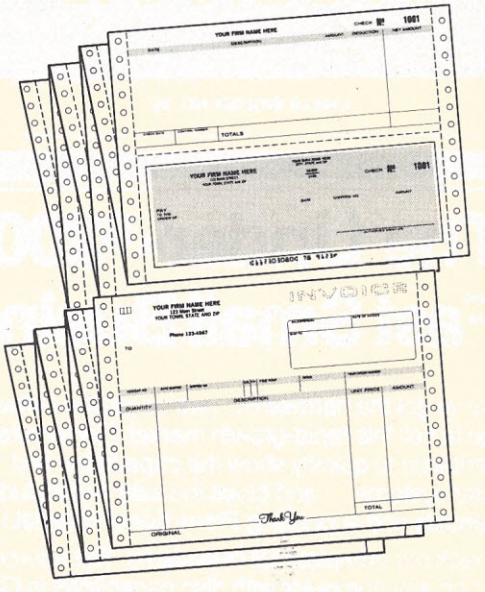
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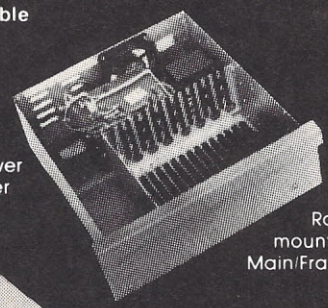
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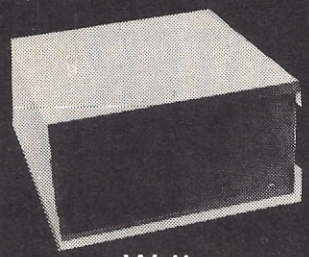
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Obviously this attempt to provide "standard" packages is based upon the realization that providing low-cost software is necessary. If such attempts are proving successful, the present costs for support and enhancements of such packages do not indicate this.

On the user side of the software question, it is clear that the average small business owner lacks programming skills. Typically, he believes that programming skills in BASIC is a trivial task. In reality, the sophistication of his requirements and the obvious restrictions of languages such as BASIC have joined to produce serious problems for the businessman of limited resources.

The assumption in the marketplace is that the user will employ in-house staff or use outside consultants to fulfill programming needs. Typical first-time users, however, usually have an inaccurate conception of the time and costs involved in developing software.

Furthermore, this market is often ill-prepared to sharply define specific program requirements in great detail. After all, rapid response and flexibility are keys to success of small business. What entrepreneur can afford to lock himself into methods which may require substantial alterations and subsequent costs?

Clearly, the software problem could cause significant disillusionment in the marketplace if not resolved early in the game. Manufacturers must develop a strategy for assisting dealers and customers in software education. Concurrently, they must work toward the development of workable, low-cost programming. Otherwise, the microcomputers will fail to achieve their tremendous potential in the small business marketplace.

Now that this problem has been stated in its complexity, some strategies which alone or in combination may prove a solution to the problem are suggested.

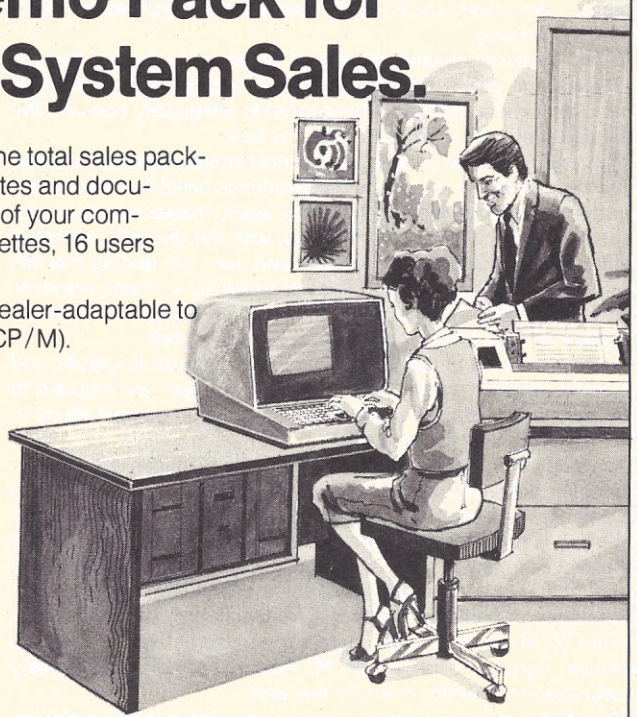
Introducing database management in the microprocessor realm would alleviate the problem of locking the businessman into programming that is too specific for his needs. This method maintains data in what is generically defined as a database. The various requirements for reports are met by processing the information within the database without specifically tailoring the data for one particular type of application. As yet, this type of approach has failed to

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CIRCLE INQUIRY NO. 41

Is Expandability the Reason Over 150,000 Smart Buyers Chose TRS-80? Or is It Price? Or...

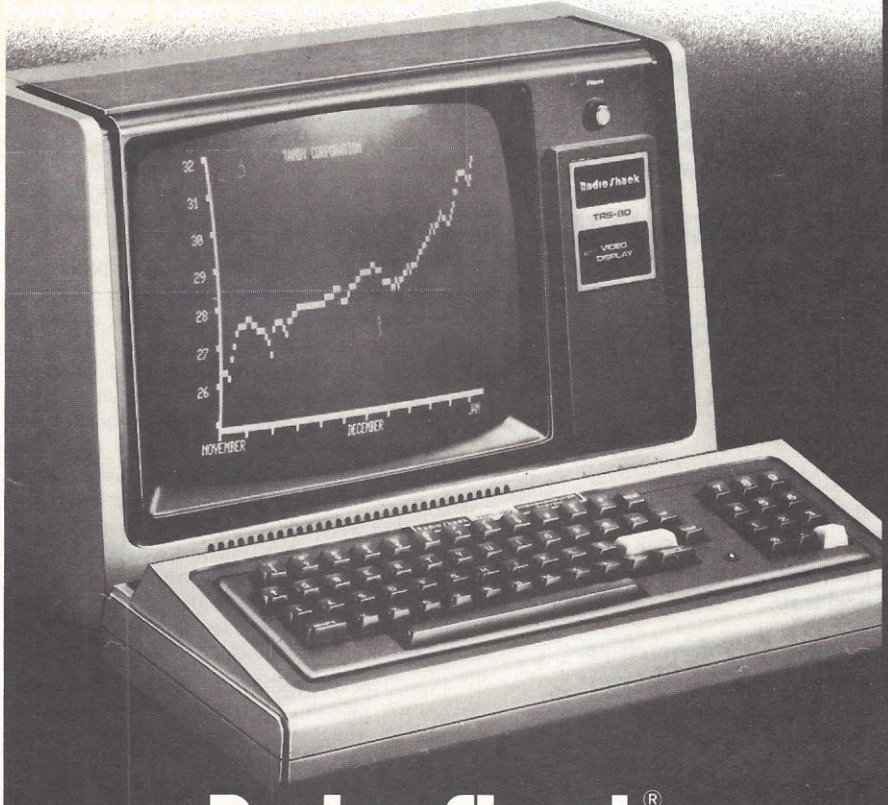
Maybe these customers came to Radio Shack for their computer because they knew they could get nationwide service? Or buy a Model I micro starter system for $499? Or because Radio Shack started the boom in reliable little computers? But come they did. And coming they still are!

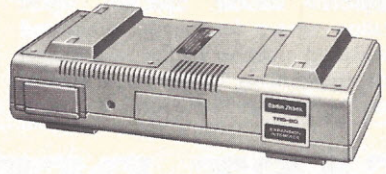
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achieve widespread attention, and, it must be added, will require several years for full development.

Parameterization is another approach to this problem. In this case, the dealer selects, from a large range of choices, those fundamental functions which are required to develop an end user's requirements. He then constructs a system which provides speed and access to various required reports.

The assumption here is that such functions are sufficiently general to make such an approach feasible. Specially, report generation, screen formatting, query and update would probably be the basic subset of such requirements. Details would then be provided by the user in the form of various parameters which are related to his particular business activity.

Parameterization permits the user to readily establish specific formats for various requirements and to easily modify such items. The user will also be in a position to custom-tailor formats for invoices, reports, correspondence, and other documents without risking exposure to subtle bugs introduced into the main body of the applications software being used.

In most cases, the initial requirement for custom fitting of software to user requirements will fall within the purview of the various "functions." This relieves both dealer and user from substantial initial investments in software development.

This type of approach will permit the buyer to start using the system rapidly. Further, the question of extension of the system capabilities is postponed. Hopefully, by the time he is able to better define critical system requirements, the user will have gained enough understanding of the system to make changes practical.

It should be understood, however, that even this attractive approach will not serve to cover the myriad and diverse requirements of the small business sector. At this point, it becomes the business/user's burden to intelligently define particular current and future program requirements. Here are some guidelines a user should follow in making such determinations about his system's requirements.

Recognize that the average applications programmer will cost $25 an hour or more to custom-tailor existing applications packages to particular requirements. Thus, an important question prior to starting such efforts is whether the package is designed to permit alterations easily. If the answer to this question is negative or unclear, considerable caution should be exercised before accepting such packages.

Be particularly cautious in reviewing packages which can be easily altered "to meet any possible contingency." This software is generally the most expensive available when changes are made.

Attempt to find those packages which most closely fit current requirements.

Decide whether system requirements are sufficiently well-defined to meet current as well as future needs. More than one package has been modified to meet critical requirements only to discover that in the interim these requirements had changed and modifications are no longer valid.

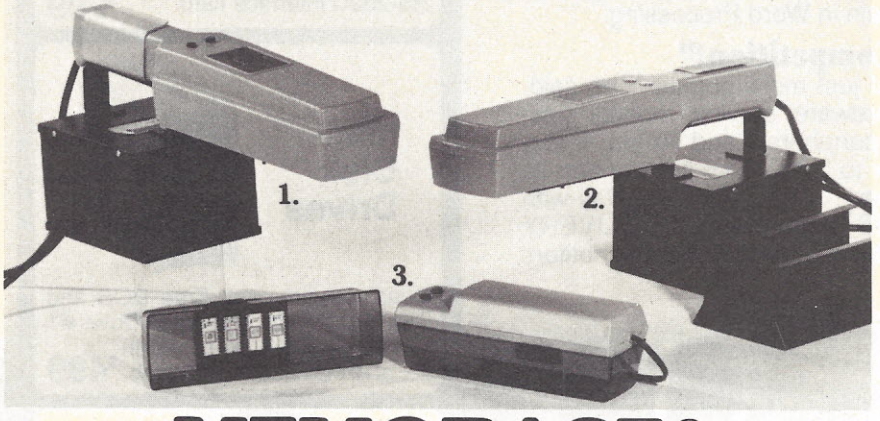
During the initial implementation of a system, every effort should be made to resist changes to software that are not absolutely necessary. This permits the user to become thoroughly familiar with the system and better able to evaluate type and extent of changes he requires. A comprehensive application package written as customer software could take as long as a year to write and debug, particularly if written in both assembly and high level language. So, in reviewing available packages, address the issue of support early in the decision making process.

To summarize, the first half of the effort to introduce inexpensive, powerful data processing capability to the small business sector has been achieved with the advent of inexpensive, reliable hardware. Further cost reductions are anticipated. However, applications software for these systems is sadly lacking.

Major innovations to shore up this weakness include database management, parameterization and better structured language programs. It may well be that the ultimate solution will be a sophisticated synthesis of these approaches.

In the meantime, the end user should exercise caution and educated judgment in selecting the software complement to what has proven to be highly cost-effective hardware.□

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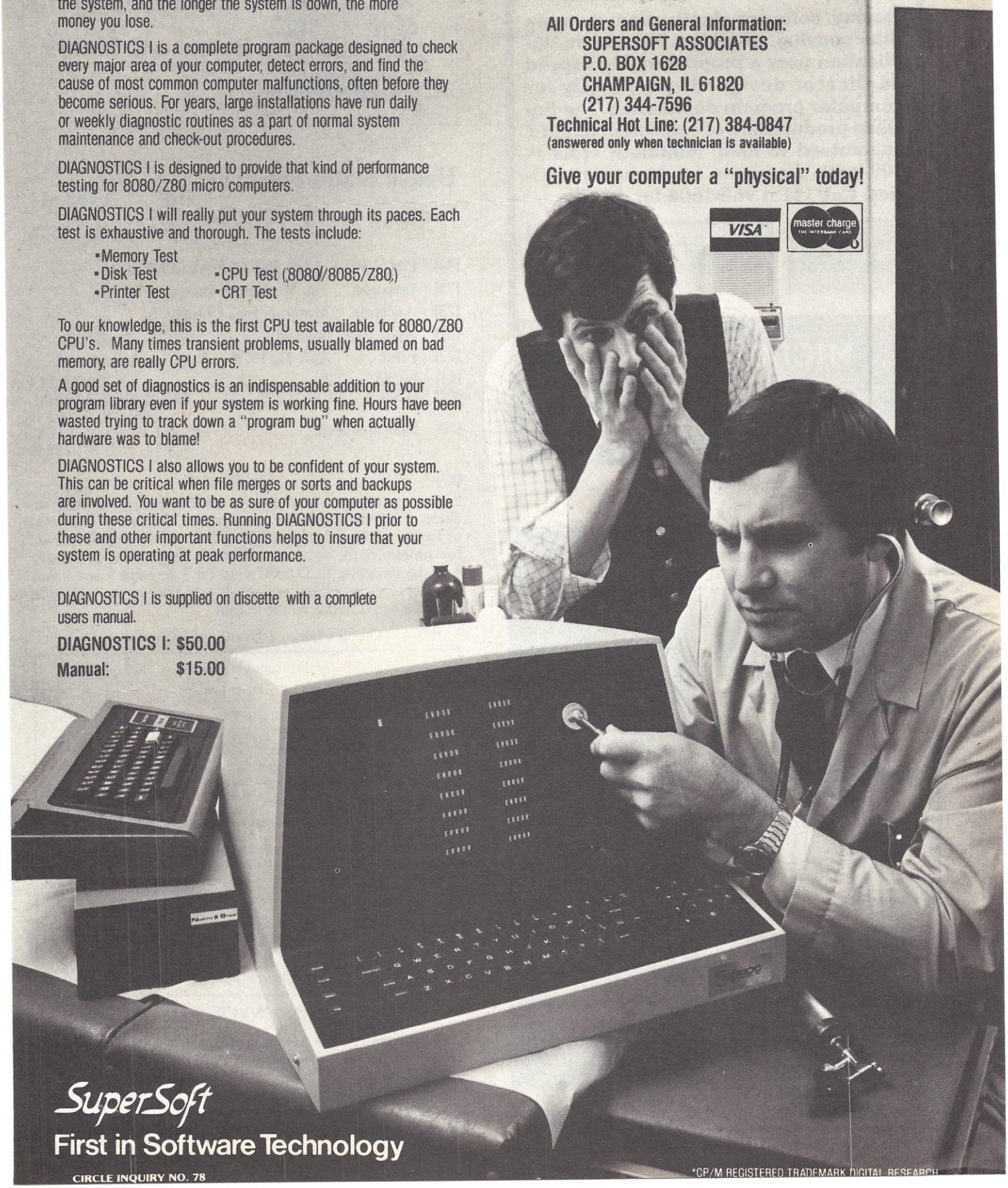
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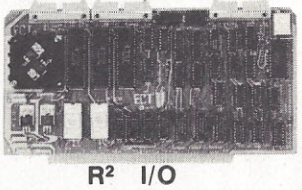
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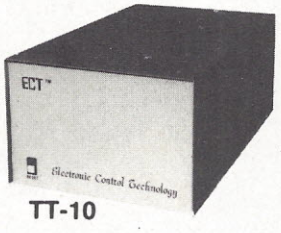
CIRCLE INQUIRY NO. 55

BUILDING BLOCKS FOR MICROCOMPUTER SYSTEMS, CONTROL & TEST EQUIPMENT



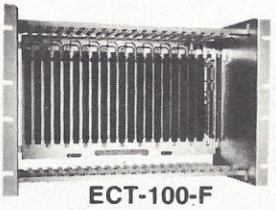
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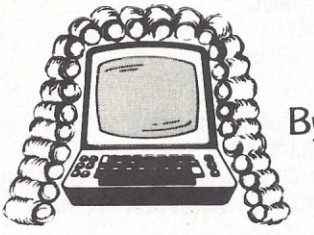
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CIRCLE INQUIRY NO. 25

JURISPRUDENT COMPUTERIST



By Leonard Tachner
Attorney-at-Law

United States Patent [19]
Henry

[11] **3,992,611**
[45] **Nov. 16, 1976**

[54] **PLUS FIVE AND INVERT ALGORITHM**
[75] Inventor: **Tim W. Henry,** Tempe, Ariz.
[73] Assignee: **Motorola Inc.,** Chicago, Ill.
[21] Appl. No.: **569,900**
[22] Filed: **Apr. 21, 1975**
[51] **Int. Cl.²** **G06M 3/14**
[52] **U.S. Cl.** **235/92 EV;** 235/92 CM, 235/92 CP; 235/92 R
[58] **Field of Search** 235/92 EV, 92 CM, 92 CP; 328/44, 158; 307/222 R

[57] **ABSTRACT**

A four bit binary coded decimal (BCD) up/down counter includes a four bit adder and associated logic circuitry configured to feed therethrough the incoming BCD code words as the actual output for the up count and for the down count, add binary 5 to the incoming BCD code word for 1 through 9 and invert each bit of the resulting code words, and feeding the BCD code word for zero directly to the output.

5 Claims, 2 Drawing Figures

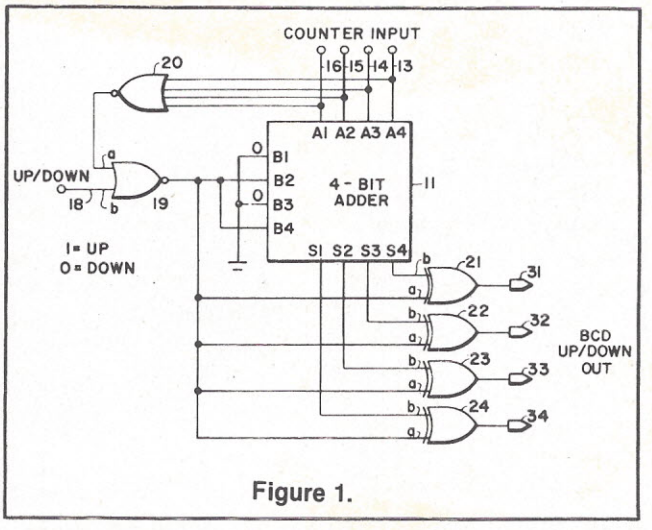


Figure 1.

PLUS FIVE AND INVERT ALGORITHM

This invention relates to a binary coded decimal (BCD) up/down counter and more particularly, an improved four bit BCD up/down counter.

Conventional BCD up/down counters include a large number of gates that are configured in the form of a complex circuitry for implementing the up/down count operations.

Accordingly, it is an object of the present invention to provide an improved up/down counter and more particularly, to provide a simplified and improved four bit BCD up/down counter.

Aforementioned and other objects of the present invention are achieved, in accordance with the present invention, by a four bit BCD up/down counter which includes input means for receiving an incoming BCD code words for zero through nine, output means, means providing an up count or down count command signal, circuitry interposed between said input and said output means for feeding the incoming BCD code words therethrough as is in response to the up count command signal and adding binary code for 5 to the incoming BCD code words 1 through 9 and inverting each bit of the resulting BCD code words and retaining the input BCD code word for **0** as is, in response to the down count command signal, and output means for providing the up count and down count BCD code word output in response to the up and down count command signal selectively.

DETAILED DESCRIPTION

In accordance with the present invention, the up/down counter is configured to implement the following algorithm in providing the up and down count of the incoming BCD code words 0 through 9. The algorithm involved in the present up/down counter can be graphically illustrated by a table of the code bits involved in the up/down counter process as follows:

BCD UP	DECIMAL NUMBERS	BCD + 5	INVERT	DECIMAL NUMBERS
0000	0	0000	0000	0
0001	1	0110	1001	9
0010	2	0111	1000	8
0011	3	1000	0111	7
0100	4	1001	0110	6
0101	5	1010	0101	5
0110	6	1011	0100	4
0111	7	1100	0011	3
1000	8	1101	0010	2
1001	9	1110	0001	1

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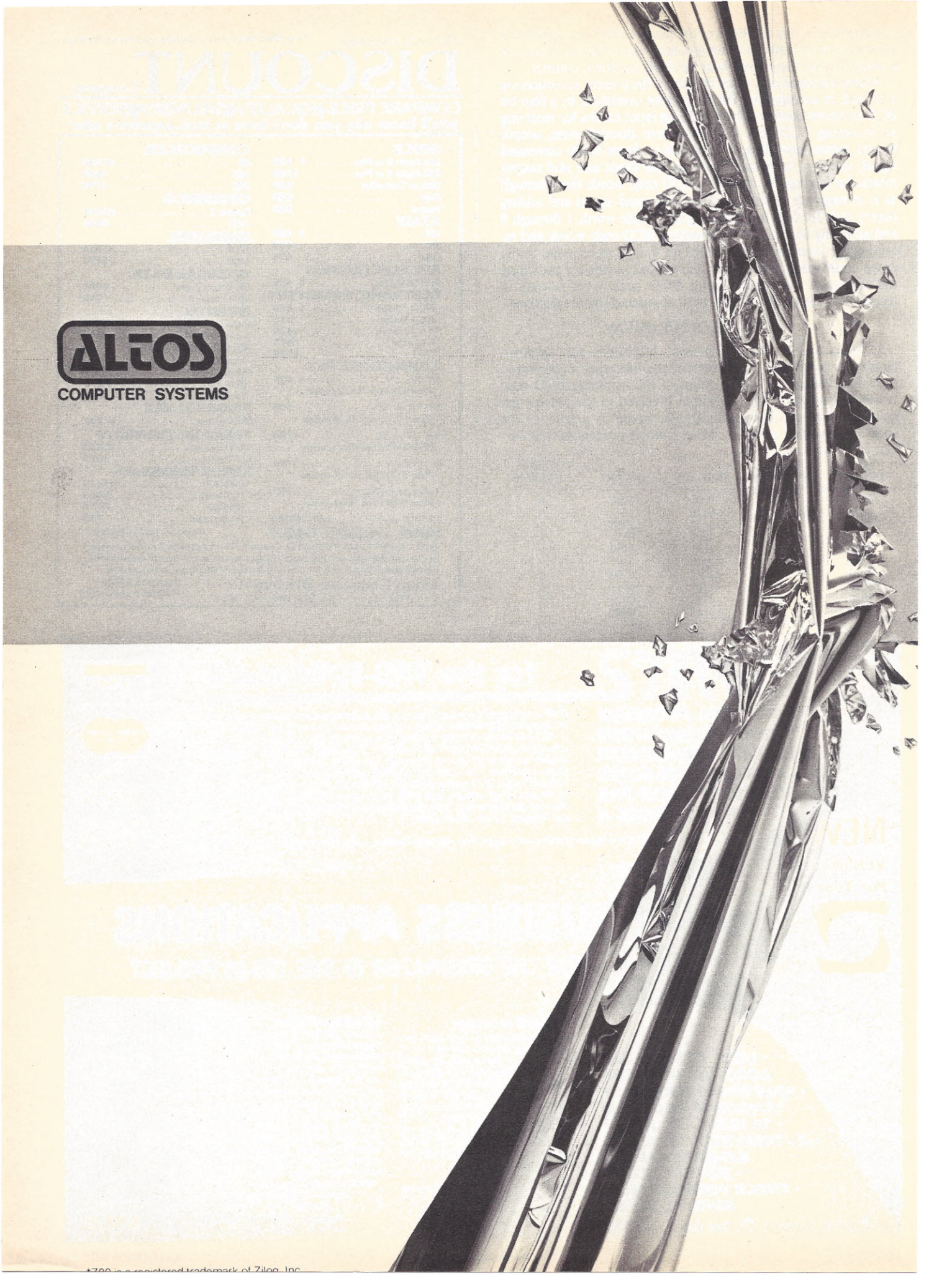
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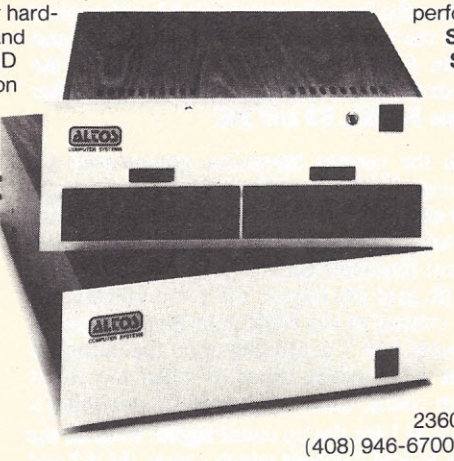
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CIRCLE INQUIRY NO. 2

As shown in the left column above, the conventional BCD code for decimal numbers 0-9 may be presented in the form of four bit codes. The present up/down counter is configured to feed the BCD codes for the decimal numbers 0-9 therethrough to the output. For the down count process the binary code word for decimal number zero, i.e., BCD code **0000,** is fed through the counter as is to the output. This is shown in the first row of the table above. And for the BCD codes for the decimal numbers 1-9, the down count is attained according to the following. First, binary code for the decimal number 5, namely 0101, is added to each code word. The resulting code words are shown in the middle column under the heading BCD+5. Each bit of the resulting BCD code words for the decimal numbers 1-9 are then inverted. The result of the inversion is in the column at the right hand side under the heading INVERT. Note that the resulting code words after the inversion represents the BCD code word in down count sequence as opposed to the up count sequence of the BCD codes shown in the extreme left column. So in the application, for the down count operation, if the incoming code words are in the form of BCD up count sequence, 0,1,2,3,4,5,6, 7,8, and 9, then the resulting output BCD code words will be in the down count sequence, of 0,9,8,7,6,5,4,3,2, and 1 by imposing BCD+5 and inversion on the incoming code words as described above. If the count is for the up count, then the incoming BCD codes for 0-9 are fed through the counter as is.

The aforementioned mathematical algorithm is advantageously implemented by a counter circuit schematically illustrated in FIG. **1.** As shown the counter comprises a four bit adder **11** and a plurality of logic gates operatively connected to implement the logical operations required by the algorithm for providing the up count and down count. More particularly, the counter includes input means **13—16** for receiving the four bit up count BCD and apply them to the four bit adder **11.** There is also provided an up/down command signal input means **18,** the up count command signal may be in the form of logical 1 and the down count command signal may be in the form of logical 0 applied to the counter. There are provided a pair of NOR gates **19** and **20** connected as shown to provide the logical functions as shall be explained hereinbelow. The NOR gate **20** is interposed between one of the input *a* of the NOR gate **19** and the input means **13—16** for the four input bits. The up/down command signal is applied to the other input *b* of the NOR gate **19.** The output of the NOR gate **20** connected to four OR gates **21** through **24** at one of their inputs, *a*'s, as illustrated. The four bit adder **11** may be of any conventional design configured to add a first four bit digital word to a second four bit digital word and provide a sum in the output. Thus, it may be configured to receive the four bits from the four bit input leads **13—16** applied to the four bit adder at the terminals designated **B1, B2, B3** and **B4.** The four bits from **A1, A2, A3** and **A4** are added to the other four bits of the second four bit code words from the other four bit input terminals **B1, B2, B3** and **B4.**

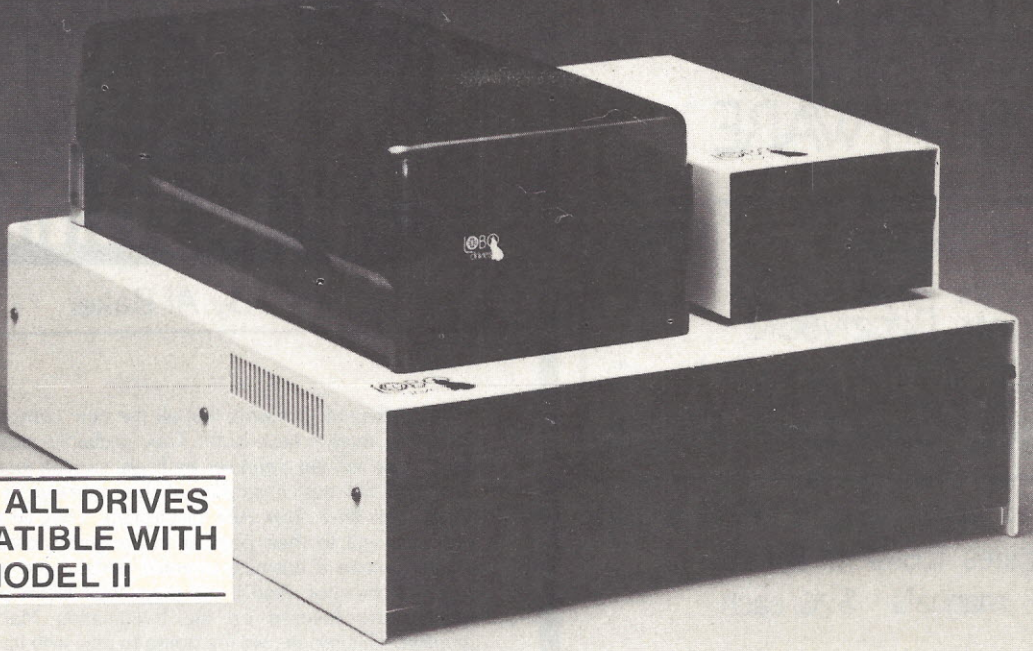
In accordance with the present invention, second four bit words are used to provide BCD+5 and inversion for the down count as follows. First and third bit positions, i.e., **B1** and **B3** are grounded to provide logical 0 always. On the other hand, the second and fourth input terminals **B2** and **B4** are connected to the output of the NOR gate **19.** Hence, the two terminals **A2** and **A4** are under the control of the NOR gate **19,** and receives the logical signal of either 0 or 1 depending upon the output of the gate **19.** The gate **19** provides logical 0 when the count operation is for the up count. This is achieved by providing a command signal of logical 1 for the up count signal. In turn, the NOR gate **19** provides logical 0 output which causes the **A2** and **A4** bit positions to be logical 0. Consequently, the four bits applied to the input terminals at **B1, B2,** and **B3,** and **B4** are all logical 0. As a result, the four bit adder feeds in effect, the incoming four bit codes from the other four bit terminals **A1, A2, A3** and **A4** as is, therethrough to the output summing terminals **S1, S2, S3** and **S4.** The four bit output of the four bit adder are then fed to the second input *b* or the other input terminals of the OR gates **21** through **24.** Since the gate output of the NOR gate **19** is logical 0, the output of the OR gates **21—24** are the same as the input at the other input terminals *b*, i.e., the output of the summing terminals **S1, S2, S3,** and **S4.** Consequently, with the up command signal of logical 1, the counter feeds the incoming four bit up count BCD words therethrough to the outputs of OR gates **21—24** as is. Accordingly, the output of the counter circuitry at the output terminals **31, 32, 33** and **34** are the same as the input code words applied to the input terminals **13.**

Now for the down count process, the gates **19—24** and the down count command signal of logical 0 serves the purpose of enabling the four bit adder to down count incoming four bit code words as follows. With any combination of code bits, except for the code words for the number 0, the NOR gate **20** provides logical 0 output. This is applied to the input *a* of the NOR gate **19.** Since the down count command signal is logical 0 the output of the NOR gate **19** becomes logical 1. This means that the four bit input applied to the terminals **A2** and **A4** becomes logical 1. Thus, the four bits for the four bit terminals **B1, B2, B3** and **B4** becomes four bit code words that represent decimal number 5, namely 0101. The four bit adder serves its conventional summing function of adding this four bit word 0101 to the incoming four bit code words 1—9 and provides the summed outputs through the output terminals **S1, S2, S3** and **S4.** The output at the summing terminals **S1** through **S4** appears in the form of the BCD+5 column shown in the middle of the above table. Now the output of the NOR gate **19** in the form of logical 1 is applied to terminal *a* of OR gates **21—24.** In turn, the OR gates **21—24** serves the function of inverting the output of the four summing output terminals **S1-S4** applied to the *b* terminals, thereof. Each bit of the output of the terminals **S1-S4** are inverted by the logical function of the OR gate **21—24.** The inverted output applied to the output terminals **31** through **34.** This is shown in the column on the right hand side in the above table under the heading INVERT.

Note that for the BCD code word for decimal number 0 in the down count operation, the NOR gates **19** and **20** serve the function of providing logical 0 to the terminals **B2** and **B4** at the four bit input terminals. Thus, the down count command is applied to logical 0 the terminal *b* of NOR gate **19** and logical output of logical 1 is applied by the NOR gate **20** at the input terminal when all four input bits at the input bits at the input terminals **13—16** are logical 0, the all four input bits at the input terminals **13** are logical 0. Consequently, NOR gate **19** provides logical 0 output. Hence, the four second bit input at **B1, B2, B3** and **B4** provide BCD code word for zero, i.e., 0000. Hence, the four bit adder feeds therethrough the four bit code word for decimal 0 to the summing output terminals **S1-S4** in the form of a BCD code word for 0. The OR gates **21—24** do not serve the function of inverting the BCD code word for 0 at this point, since the output at the NOR gate **19** is logical 0.

In summary, it has been shown above that a counter having a four bit adder and associated logical gates **19—24** are configured to implement the aforementioned mathematical algorithm in providing the up count or down count in response to the up count or down count command signal. Thus, the counter is designed so that, in response to the up count command signal, its four bit adder and the associated logic circuitry feed the input therethrough as is as the output. However, in response to down count input command signals, the counter adds BCD code word for 5 to the incoming code words for 1—9 and invert each bit of the resulting summed code words to provide the down count output. The four bit adder and associated logic gates are also configured so that the BCD code word for decimal 0 is fed therethrough as is and applied to the output terminal as BCD code word 0 for the down count operation.□

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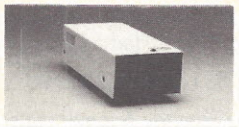
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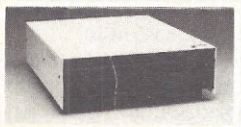
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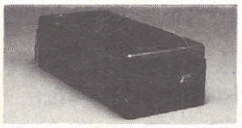
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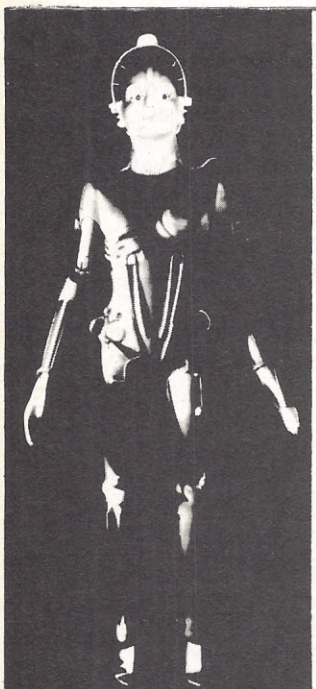
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AL BAKER'S GAME CORNER

By Al Baker

Color! Sound! It seems that all the new computers entering the consumer market have both. They probably must to survive. The video game and the computer are finally coming together in the home.

One of the best examples of this marriage is the Imagination Machine or IM-1, from APF Electronics. They've added a keyboard and tape unit to their popular video game, creating a computer which contains a business-oriented BASIC and a simple machine language monitor. And it still plays their ROM plug-in games. In January, we focused on the Imagination Machine's handheld keypads. This month, we are going to play with its color and sound.

Several people have asked me to convert the game presented in the December column to the Imagination Machine. There is no better way of showing color and sound. The game, Play After Me, is similar to the game Simon from Milton Bradley and Merlin from Parker Brothers. The December version of Play After Me was a solo game. Now we are going to play its challenging, two-player big brother.

PLAY AFTER ME

Each player takes a handheld joystick. The left player begins by moving the joystick up, down, left or right. This plays a note and lights up a colored bar at the top, bottom, left or right side of the TV screen.

The right player now must repeat this note by moving his joystick and then adding a new note. Now the left player must play both notes and then add a third. This continues with each player playing all former notes and then adding a new note. The game ends when either player makes a mistake. The other player's score is increased by the number of notes that should have been played.

The players can continue to play and the score will continue to mount until one of the players decides he has been properly humiliated. At least that's how I felt after being destroyed by my wife.

ABOUT THE COMPUTER

The Imagination Machine is one of the easiest computers on which to play music. Here is the song "Mary Had a Little Lamb:"

MUSIC "3212333 222 355 3212333 2232100"

The numbers 1 through 7 are the notes in the A major scale starting with A above middle C. Place a + in front of a note to make it sharp and a – in front of a note to make it flat. F sharp is +6. B flat is –2. Placing a / in front of a note drops it an octave and placing an * in front of a note raises it an octave. Middle C sharp is /+3 or +/3 and B flat two octaves up is *–2 or –*2. A note is extended by adding zeroes after it. Spaces are used to designate rests.

There are five BASIC statements used to place color on the TV screen. The color register is set to one of eight colors by assigning a number between 0 and 7 to the variable COLOR. The colors are:

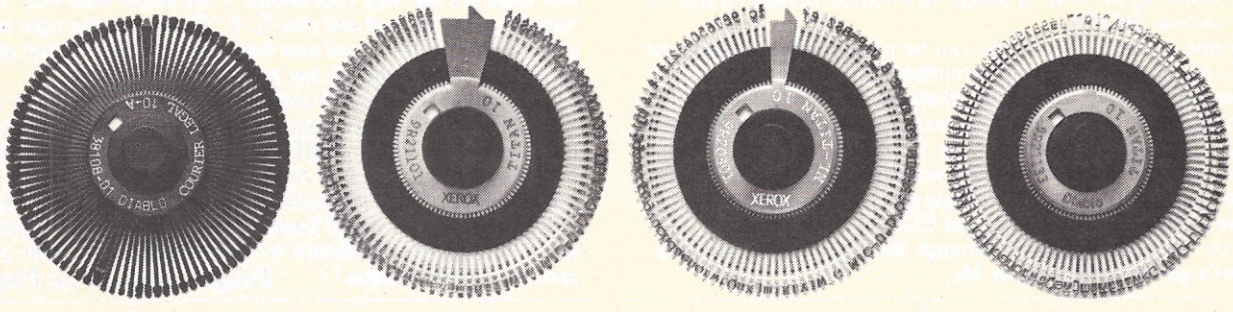
0 = light green	4 = white
1 = yellow	5 = light blue
2 = blue	6 = purple
3 = red	7 = orange

The SHAPE statement is harder to describe. The IM-1 divides the TV screen into 16 rows of 32 positions. Each of these 512 positions can contain a shape. There are 16 different shapes. These are:

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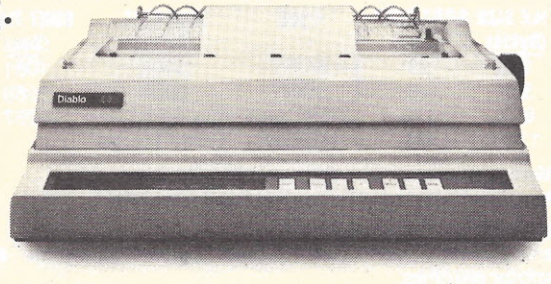
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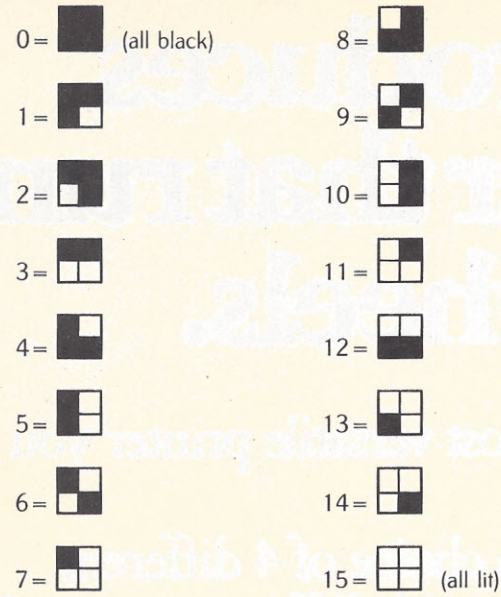


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CIRCLE INQUIRY NO. 81



The shape register is set by assigning a number between 0 and 15 to the variable SHAPE.

Any one of the 512 positions can be plotted with the statement PLOT column, row. Column is a number from 0 to 31 and row is a number from 0 to 15. The shape plotted is taken from the SHAPE register and the color of the lit portions of the shape is taken from the COLOR register. A horzontal line is plotted with HLIN from-column, to-column, row. A vertical line is plotted with VLIN from-row, to-row, column. Again, the shape and color of each position in the line are taken from SHAPE and COLOR.

We've taken an excursion through the Imagination Machine. Now let's go look at Play After Me.

THE GAME

Lines 10 to 140 set up the game. The T$ string can hold up to 99 notes. A$ will be used to receive a player's input. Line 100 contains a machine language call. The routine at 17046 blackens the screen.

Lines 150 through 630 play the game, alternating first player. The subroutine at 1000 sets up the TV screen. It blackens the screen and then places fully lit white bars at the top, bottom, left and right.

The routine starting at 2000 is where the player is asked to repeat all of the current notes in the tune. Lines 2000 and 2002 set the current print locations to the third position of the eighth line on the TV. How these two memory locations work is described in my January column.

The TV screen is contained in the 512 memory locations starting at location 512. Putting a 3 in locations 40960 and 40961 sets the current print position to memory location 3*256+3 or 771. This is location 771–512 or 259 on the TV screen. I will leave the proof that location 259 is position 3 of line 8 to the reader.

The routine starting at 3000 asks the current player for a new note. The routine beginning at 4000 handles receiving input from the player, playing the note and coloring the correct bar on the TV screen. Line 4000 waits for an input from the correct keypad. The left player is player 0. He is using keypad 2. The right player is player 1 and is using keypad 1.

The responses obtained from the joystick are the strings "N" for up, "S" for down, "W" for left, and "E" for right. You will notice that these are the map coordinates. If the player responds "N", we turn the upper bar red and play G. If "E" we turn the right bar blue and play low C. If "S" we turn the bottom bar purple and play low A. If "W" we turn the left bar green and play E.

Lines 200 through 270 are where the player plays the current tune correctly and adds a note. If he misses, lines 500 through 610 print the scoreboard. Lines 615 and 616 play the Funeral Dirge. It's now the other player's turn to start the tune. And so on. . .

If you have any questions about this game or any of my other columns, please write. If you have a question about writing your own game, I'd also be interested in covering it, either with you or, possibly, in these pages.□ **Program follows on Page 40**

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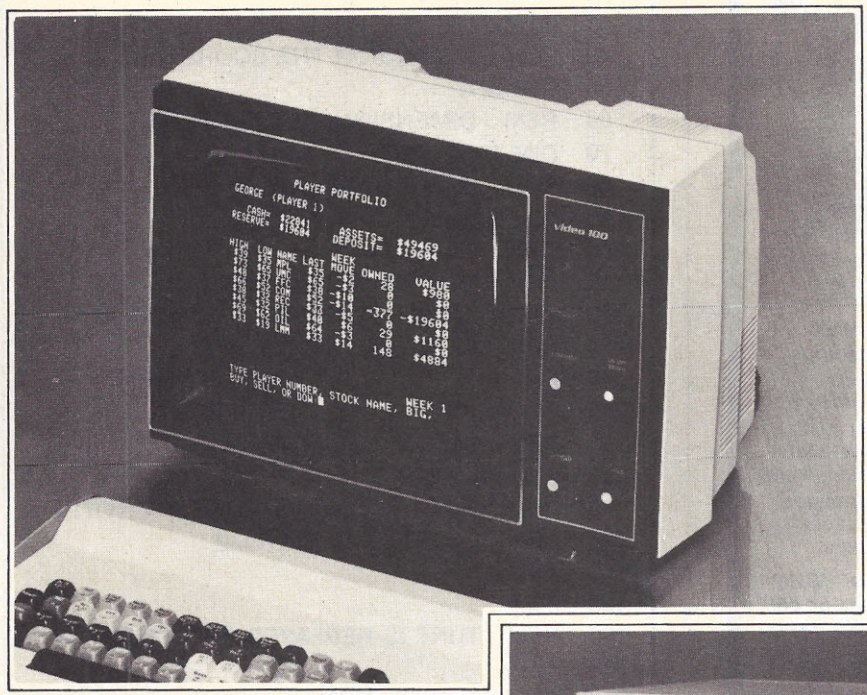
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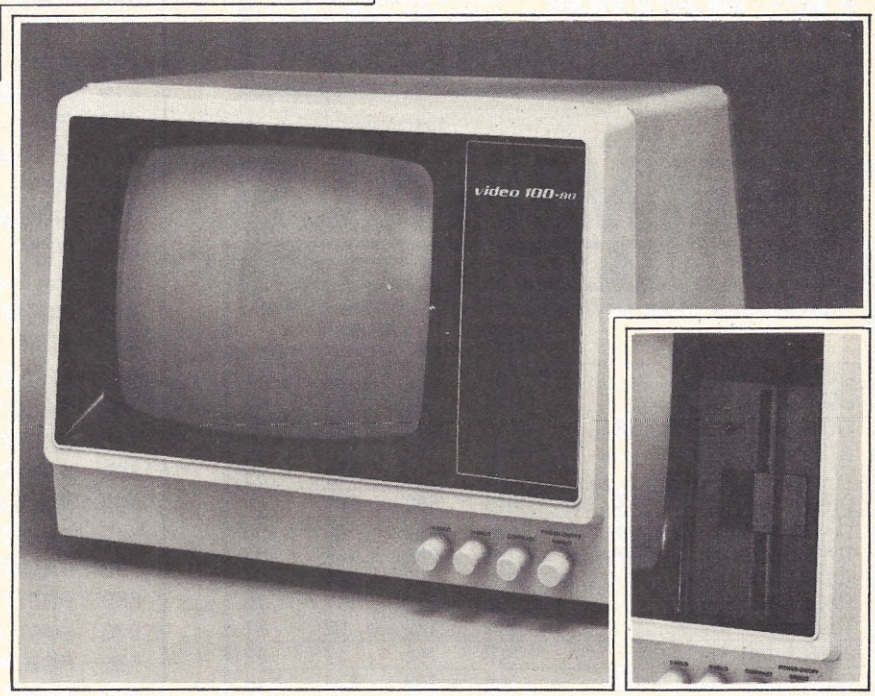
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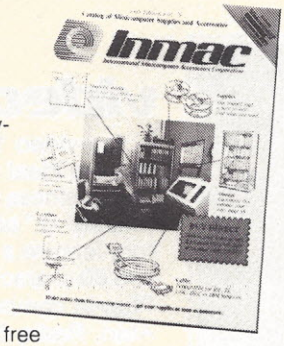
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LA120 DECwriter III KSR	2,295	220	122	83
VT100 CRT DECscope	1,895	182	101	68
VT132 CRT DECscope	2,295	220	122	83
DT80/1 DATAMEDIA CRT	1,895	182	101	68
TI745 Portable Terminal	1,595	153	85	57
TI765 Bubble Memory Terminal	2,795	268	149	101
TI810 RO Printer	1,895	182	101	68
TI820 KSR Printer	2,195	210	117	79
TI825 KSR Printer	1,695	162	90	61
ADM3A CRT Terminal	875	84	47	32
QUME Letter Quality KSR	3,195	306	170	115
QUME Letter Quality RO	2,795	268	149	101
HAZELTINE 1410 CRT	875	84	47	32
HAZELTINE 1500 CRT	1,195	115	64	43
HAZELTINE 1552 CRT	1,295	124	69	47
DataProducts 2230 Printer	7,900	757	421	284
DATAMATE Mini Floppy	1,750	168	93	63

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CIRCLE INQUIRY NO. 86

PROGRAM LISTING

```
 10  REM  . . .PLAY AFTER ME. . .
 20  REM
 30  REM
 40  REM  DIMENSION THE SCORE
 50  DIM S(1)
 60  REM  DIMENSION SIMON'S TUNE
 70  DIM T$(99),A$(1)
 80  REM  NAME THE PLAYERS
 90  DIM NA$(1,9)
100  CALL 17046
110  INPUT "LEFT PLAYER'S NAME",NA$(0,0)
120  INPUT "RIGHT PLAYER'S NAME",NA$(1,0)
130  REM  PICK THE FIRST PLAYER
140  I = 1
150  I = 1-I
153  REM  SET UP THE SCREEN
156  GOSUB 1000
160  REM  NOTE COUNT = J, CURRENT NOTE = K,
165  REM  CURRENT PLAYER = P
170  J = 1
180  P = I
190  REM  TUNE IS REPLAYED FROM HERE
200  K = 1
210  IF K<J GOSUB 2000
220  REM  DID PLAYER MISS
230  IF K<J THEN 500
240  REM  PLAYER ADDS NOTE
250  GOSUB 3000
260  REM  CHANGE PLAYERS AND LOOP
270  P = 1-P
280  GOTO 200
490  REM  PLAYER MISSED, GIVE OTHER SCORE
500  PRINT
505  CALL 17046
510  PRINT NA$(P,0);"MISSED"
520  PRINT
530  P = 1-P
540  PRINT NA$(P,0);"GETS";J;"POINTS."
550  PRINT
560  PRINT "SCORES:"
570  S(P) = S(P) + J
580  FOR P = 0 TO 1
590  PRINT NA$(P,0);"HAS";S(P);"POINTS."
600  NEXT P
610  PRINT
615  MUSIC "/20000 /20000 /2 /20000 /40000 "
616  MUSIC "/3 /30000 /2 /20000 /-2 /20000"
620  INPUT "PRESS RETURN FOR NEXT GAME",K
630  GOTO 150
990  REM  SCREEN SET UP
1000 CALL 17046
1010 SHAPE = 15
1020 COLOR = 4
1030 HLIN 0,31,1
1040 HLIN 0,31,14
```



I made the TRS-80* into a serious computer. Now I've made the Model II into a spectacular one.

I'm Irwin Taranto, and I've helped almost a thousand businesses get their first computers up and running.

I've done it primarily with the TRS-80, because it's a really elegant piece of hardware. Given the right programs, it can do substantially the same work as the traditional minicomputers that cost four times as much.

I proved it with four on-line, interactive programs adapted from the genuine Osborne & Associates systems, originally designed for the $30,000 Wang computer. Then I added two of my own and made them all work on a $4000 TRS-80.

Now I've done the same thing for the new TRS-80 Model II. It's an $8000 computer that works twice as fast and has four times the memory—up to two million characters.

My new systems are fully documented, and because I'm working with a much more powerful computer, they're a night-and-day advance over the Model I programs. They'll turn your Model II into a complete business computer, set up and ready to go.

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General Ledger/Cash Journal: handles up to 7000 transactions on 500 different user-defined accounts. It keeps track of them by month, quarter and year, makes comparisons to the prior year, and does departmentalization.

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Accounts Receivable/Invoicing: keeps track of billed and unbilled invoices, open and closed items, aging and service charge calculation. It prints statements, links to the general ledger, and can work within either an invoice-linked or balance-forward accounting system.

Payroll/Job Costing: computes regular, overtime and piecework pay, keeps employee files, figures taxes and deductions, prints checks, journal, 941-A and W-2 forms, and breaks out individual job costs.

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When I say set up and ready to go, I mean just that. If you're not quite sure on that point, call the number below and we'll give you the names of some of the people who've already bought all over the world. Call them up and hear what they have to say.

These Model II programs are completely custom-tailored, which explains their $249.95 price. Before we'll send you a disk, you have to fill out a detailed questionnaire that tells us your precise business requirements. Then we send you the disk, all the instructions you need, and my phone number. If you call, we answer all your questions. If your questions are tough enough, I'll talk to you personally.

Because that way I'll make sure that Model II of yours turns into a spectacular computer, just like I promised.

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CIRCLE INQUIRY NO. 14


```
1050  VLIN 0,15,1
1060  VLIN 0,15,30
1070  RETURN
1990  REM   REQUEST REPLAY OF TUNE
2000  POKE 40960,3
2002  POKE 40961,3
2004  PRINT SPC (26);
2006  POKE 40961,3
2008  PRINT "PLAY NOTES, ";NA$(P,0);
2010  GOSUB 4000
2015  A = ASC (A$)
2020  B = ASC(T$(K))
2030  IF A<> THEN RETURN
2040  K = K + 1
2050  IF K = J THEN RETURN
2060  GOTO 2010
2990  REM   REQUEST NEW NOTE
3000  POKE 40960,3
3010  POKE 40961,3
3020  PRINT SPC (26);
3030  POKE 40961,3
3040  PRINT "ADD NOTE, ";NA$(P,0);
3050  GOSUB 4000
3060  T$(J) = A$
3065  J = J + 1
3070  RETURN
3990  REM   ACCEPT, PLAY, AND SHOW NOTE
4000  A$ = KEY$ (2-P): IF A$ = "" THEN 4000
4010  IF A$<>"N" THEN 4080
4020  COLOR = 3
4030  HLIN 0,31,1
4040  MUSIC "/700000"
4050  COLOR = 4
4060  HLIN 0,31,1
4070  RETURN
4080  IF A$<>"E" THEN 4150
4090  COLOR = 2
4100  VLIN 0,15,30
4110  MUSIC "/300000"
4120  COLOR = 4
4130  VLIN 0,15,30
4140  RETURN
4150  IF A$<>"S" THEN 4220
4160  COLOR = 6
4170  HLIN 0,31,14
4180  MUSIC "/100000"
4190  COLOR = 4
4200  HLIN 0,31,14
4210  RETURN
4220  IF A$<>"W" THEN 4000
4230  COLOR = 0
4240  VLIN 0,15,1
4250  MUSIC "/500000"
4260  COLOR = 4
4270  VLIN 0,15,1
4280  RETURN
```

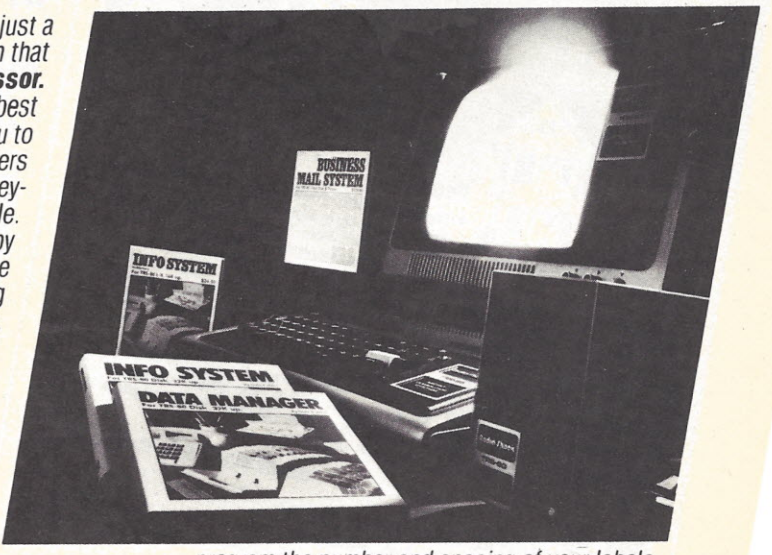
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DATA MANAGER *by Dale Kubler starts out where INFORMATION SYSTEM leaves off. Requiring 32K and one disk, it accepts up to ten user-defined fields with up to forty characters per field and 255 characters per record. As with all TBS software, data entry and editing is professional and simple to use. What makes this program stand apart from "in-mem" data managers is that it uses up to four disks on line as memory, or as much as 320K of memory storage. Because disk sorts take more time than in-mem sorts,* ***DATA MANAGER*** *enables the user to create and maintain up to 5 "key" sort files for quick access of data. A utility program is provided to calculate the number of records possible since the amount of records you can maintain is dependent on a number of variables. This program also supports the upper/lower case modification, and printouts can be programmed to almost any format and sent to line or serial printer. Background printing is provided enabling the computer to search and print at the same time. If you already have INFORMATION SYSTEM,* ***DATA MANAGER*** *will accept those files. A necessity for organized people, this program sells for $49.50.*

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TEXT MERGE *is the program that puts it all together. If you have the ELECTRIC PENCIL from Michael Shrayer, 32K and one disk drive, then this program is a must. It will merge your data base from any of the above programs with an Electric Pencil file. For example, when you write a letter that is going to several hundred people, you can "code" it by entering a field name from the above programs in place of the actual information. Then, when* ***TEXT MERGE*** *is run, it will print out your Pencil file and substitute the "code" with the actual data. In other words, you can print out 1,000 personalized letters without stopping the computer. This program will also enable you to selectively search out only the records from your data base that you wish to use. Also included is the ability to set left, right, top and bottom margins, set page numbers anywhere on the page, and print out right justified if you so choose.* ***TEXT MERGE*** *will turn your computer into a powerful data processor and it sells on disk for $49.50.*

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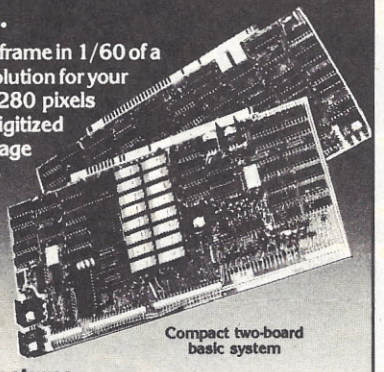
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CIRCLE INQUIRY NO. 5

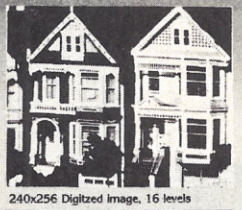
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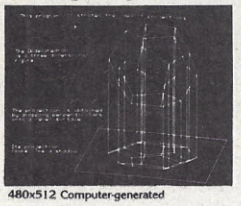
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THE MICRO-MATHEMATICIAN

By Dr. Alfred Adler

NUMERICAL ANALYSIS

During the past three months, in our headlong dash to learn more about Fourier analysis, we passed by many important details without giving them the treatment they deserved. Not the least of these was numerical integration. Referring back to Part 1 of Fourier Analysis (February, 1980), we recall that three integrals were presented, collectively referred to as the Euler formulas. These equations are required to determine the magnitudes of the Fourier coefficients. As such they are of fundamental importance to the theory of Fourier Analysis. The evaluation of each of these equations requires an integration.

INTEGRATION

Integration is a summation process. It is the opposite of the operation known as differentiation. The latter determines rate of change, often represented by the slope of a curve. The former is the inverse of this and attempts to find the function, having information regarding the rate of change. This is equivalent to finding the area under a curve. Suppose for example, we have

$$y = f(x) = x^2$$

A plot of y versus x is shown in Figure 1. Observe that from the equation or the figure it is possible, given a value for x, to determine the corresponding value for y. Using the methods of calculus, we differentiate this function. We then have

$$dy/dx = 2x$$

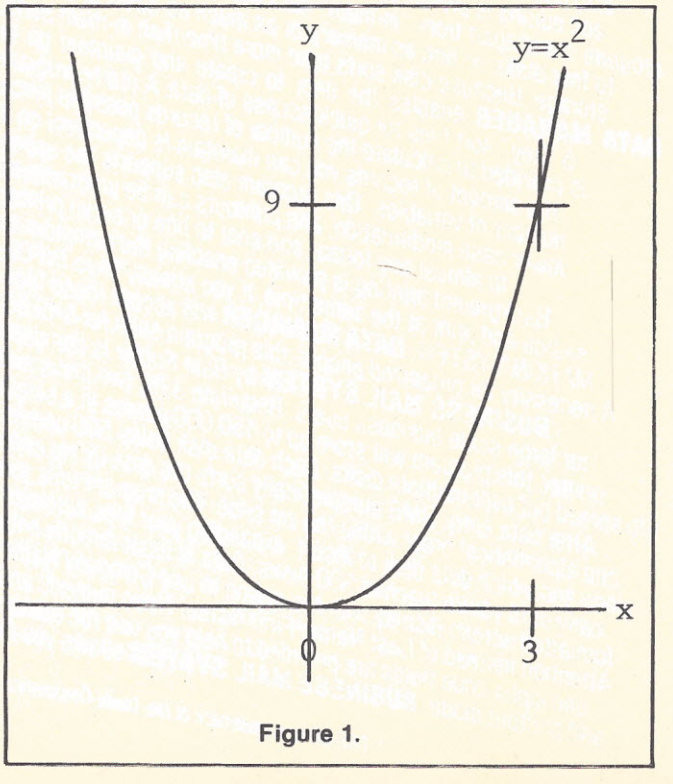


Figure 1.

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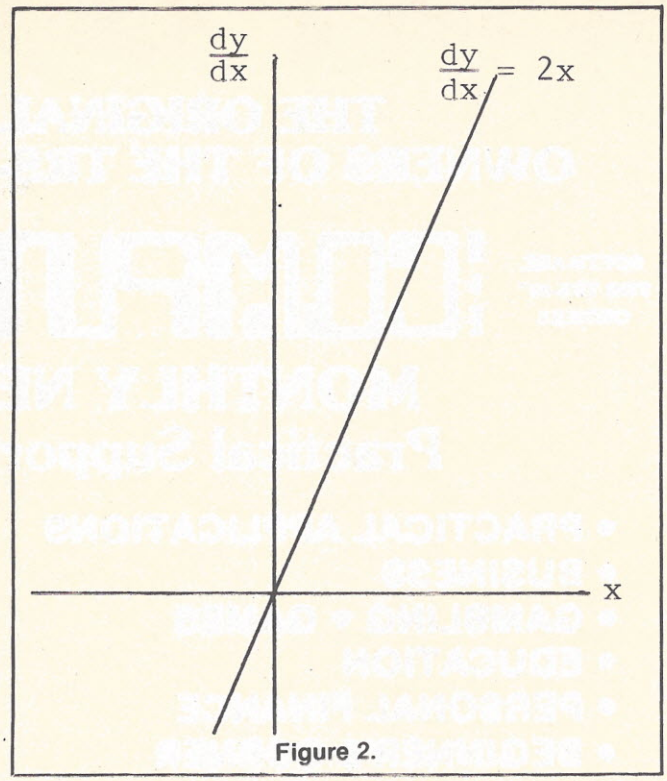


Figure 2.

A plot of dy/dx versus x is shown in Figure 2. This equation and the figure tell us that the rate of change of y, with respect to x, is 2 times x. That means that when x changes by some amount, y changes 2 times x times that amount. (This amount must be small compared with the original value of x or the above statement will not be accurate. The theory of calculus is based on changes made in small increments.) For example, if x=1 then y=1. If we change x to 1.1; that is, a change in x of .1, the second equation tells us that y will change by 2 times 1 times .1 which is .2. Thus the new y will be 1.2. That is fairly accurate, the correct value from the first equation is 1.21.

What we have done is find a new value of y by correcting the old value; the amount of the correction being dependent on the value of x. But if we try to correct too far, we become inaccurate. If we choose a new value for x of 10, that is a change in x of 9, the second equation tells us that y will change by 2 times 1 times 9 which is 18. Thus the new y will be 19. Actually from the first equation we see that the new y will be 100. The reason for the large inaccuracy was that the change in x we attempted to make was large compared to x itself.

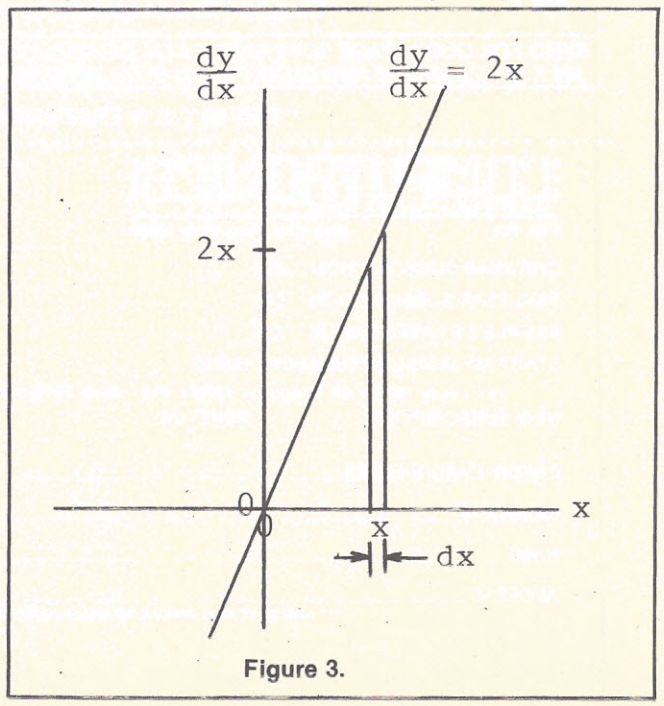


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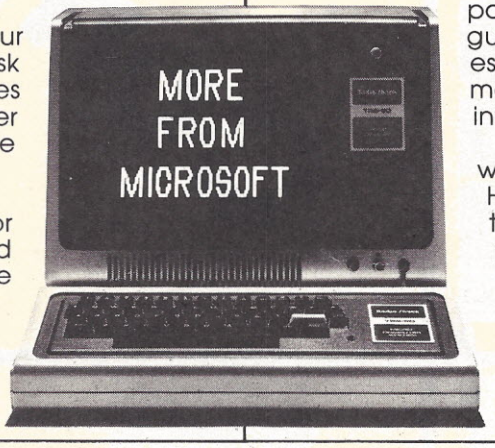
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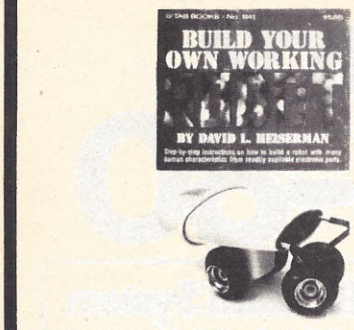
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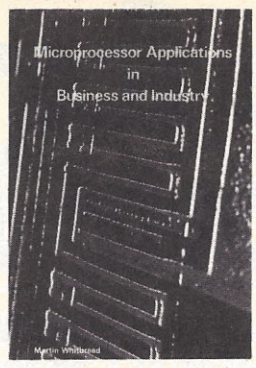
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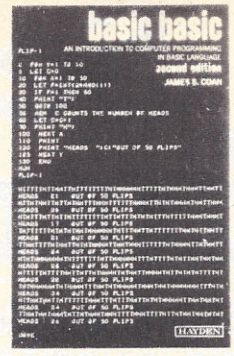
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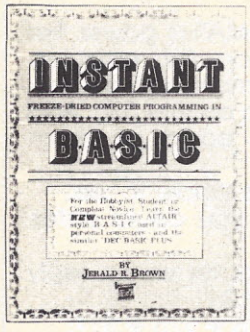
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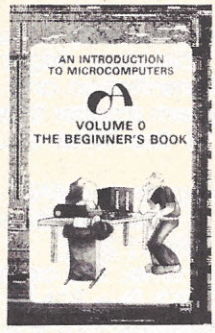
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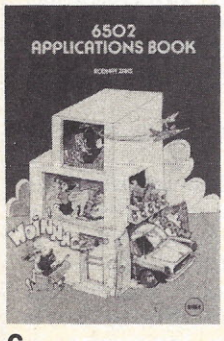
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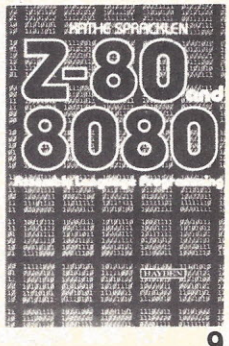


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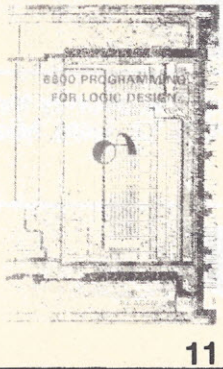
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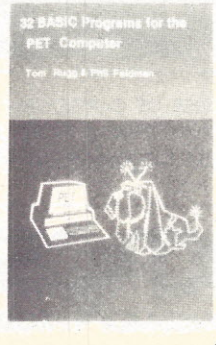
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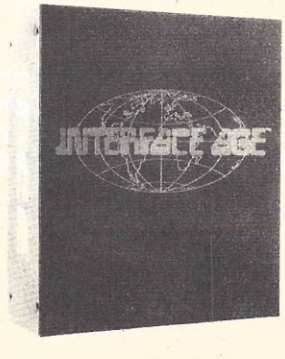
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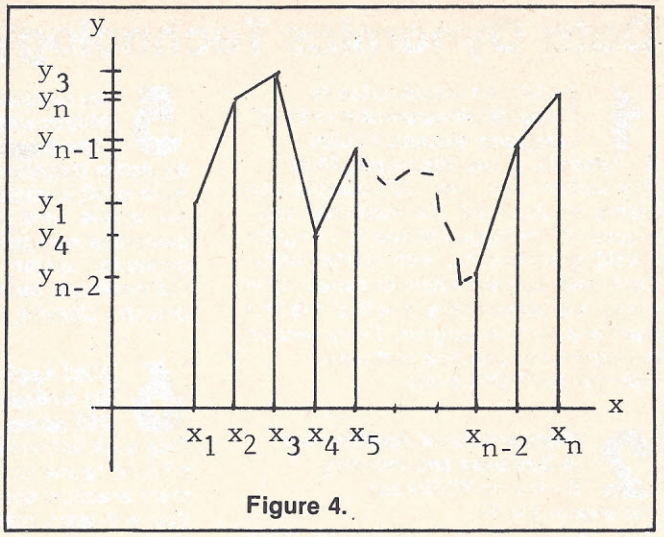


Figure 4.

The first equation describes the function itself, and Figure 1 shows a picture of the function. The second equation describes the rate of change of the function, and Figure 2 shows a picture of the rate of change of the function. We could just as well have started with the second equation and Figure 2 and integrated to come up with the original equation and Figure 1.

If we multiply both sides of the second equation by dx we have

$$dy = 2xdx$$

If we recognize that dy means a small increment in y (small compared to y); and that dx means a small increment in x (small compared to x), then this equation is another way of expressing what has already been said previously. We may now perform an integration on both sides of the above equation and thereby return to the first equation.

Using the methods of calculus, we integrate the above equation. Subject to whatever limits we impose, which in this case might properly be from zero to a general value of x, we obtain

$$y = x^2$$

We have in effect regained our original function from a knowledge of its rate of change.

As stated previously, this can also be looked upon as finding the area under a curve. The curve in this case would be Figure 2. Referring to Figure 3, where Figure 2 has been redrawn, we note that a rectangular area has been set aside under the curve. This rectangular area is of height 2x and of width dx. Its area is therefore 2xdx. We state that this area is a rectangle even though we plainly see that it is in fact a trapezoid.

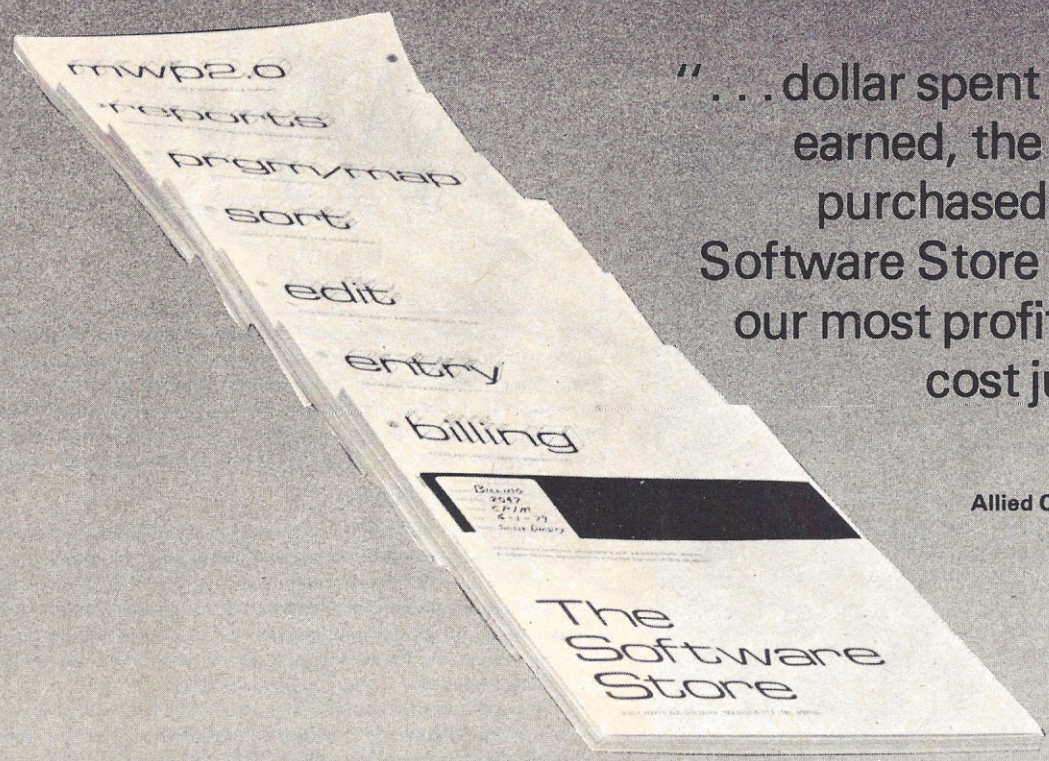
Why do we do this? Because dx is vanishingly small. Not zero, but very small. As mentioned previously, calculus is the mathematics of the infinitesimal. Since dx is vanishingly small, the error created by considering the area to be rectangular is also vanishingly small. The added complication of dealing with a trapezoid is therefore entirely unncessary. The equation can therefore be interpreted to mean that dy is the infinitesimal area of this very small rectangle.

The process of integration is the process of summing all these many (a number approaching infinity) infinitesimal areas which lie between the limits of integration. If, for example, we integrate from x=0 to x=3, we find that y=x^2, evaluated from 0 to 3. This evaluation is accomplished by substituting for x, first 3 and then 0, and differencing the results. Thus y, which is the area under the curve of Figure 2, from x=0 to x=3, is equal to 3^2 – 0^2 or 9. Reference to the first equation in this column confirms the accuracy of this answer.

Thus we show that integration determines the area under a curve. We further show that the area under the curve of the derivative of y, that is, dy/dx, from x=0 to some general value, yields the value of y at that general value of x.

NUMERICAL INTEGRATION

So far we have been dealing with functions; that is, equations in which y is expressed in terms of x. Differentiations and integrations of such functions can usually be handled according to the methods of calculus, or "analytically." Suppose, however, that the curve we want



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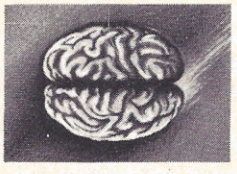
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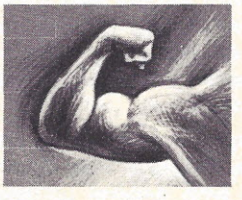
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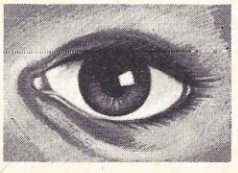
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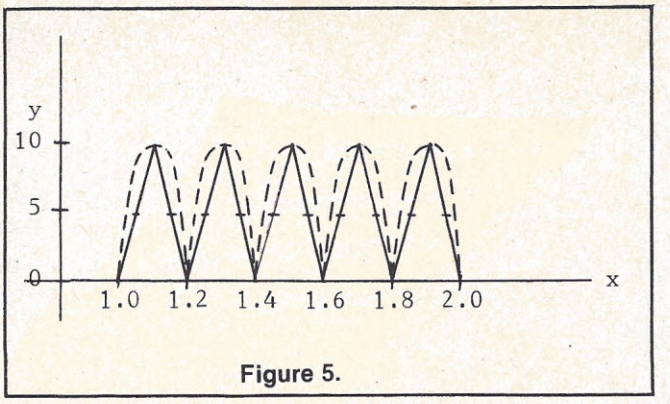


Figure 5.

to integrate (for whatever reason) is not expressible analytically (as an equation). Suppose it consists of experimental values, such as the stock prices considered in last month's column. What then? Since our analytical methods are certainly of no use to us (we don't have an equation), our only recourse appears to be to work with what we do have; namely, numbers. Thus the label Numerical Integration.

TRAPEZOIDAL RULE

It would appear that the simplest and easiest approach would be to simply connect the numerical points by straight lines, divide the area under this 'curve' into trapezoids, evaluate the area of each trapezoid, and add them up. Note that since the x distance between points is presumably no longer infinitesimal, we must now regard the subareas as trapezoids; the rectangular approximation no longer being valid. This essentially is the Trapezoidal Rule.

In Figure 4 a typical problem has been sketched. Corresponding to each of n values of the independent variable, x(1) to x(n), there is a value of the dependent variable, y(1) to y(n). It is desired to find the area under the curve from x=x(1) to x=x(n). As discussed above, we divide the area into n−1 trapezoids and evaluate each in turn. The first trapezoid lies between x=x(1) and x=x(2). Its area is

$$A = (x(2) - x(1))*(y(2) + y(1))/2$$

The second trapezoid lies between x=x(2) and x=x(3), and its area is

$$A = (x(3) - x(2))*(y(3) + y(2))/2$$

and so forth. Continuing in this manner, we sum the areas of all the trapezoids. If the interval from x(1) to x(n) is divided into equal parts, then

$$x(2) - x(1) = x(3) - x(2) = x(4) - x(3), \text{ etc. } = \Delta x$$

and the sum of all the areas becomes

$$A = (y(1) + 2*y(2) + 2*y(3) + \ldots + 2*y(n-1) + y(n))* \Delta x/2$$

This is the Trapezoidal Rule. This is the method used in Programs 4YESERES and 4YEANAL to evaluate the Euler formulas.

SIMPSON'S RULE

Under certain circumstances it is possible to obtain a significant improvement in accuracy without a correspondingly significant increase in labor. Suppose instead of connecting the numerical points, y(1) to y(n), by straight lines, we connect them by parabolas in groups of three. Thus y(1), y(2), and y(3) would be connected by a second degree parabola; y(3), y(4), and y(5) would be connected by a second parabola; and y(5), y(6), and y(7) would be connected by a third parabola, and so on. This would, of course, require that there be an odd number of y values. If there were such an odd number and if the interval along the x axis were evenly divided, the area under the curve, evaluated by Simpson's rule, would be

$$A = (y(1) + 4*y(2) + 2*y(3) + 4*y(4) + \ldots + 2*y(n-2) + 4*y(n-1) + y(n))* \Delta x/3$$

Note that the interval, Δx, is now divided by 3, not 2 as before.

PROGRAM NUMERINT

A small program, in North Star BASIC, has been written in order to facilitate comparisons between the Trapezoidal and Simpson's Rule, for either built-in analytic function or an arbitrary set of points to be input by the user. The built-in function shown in the listing is a sine curve between 0 and π/2. This can easily be changed to any other closed form function by simply altering statement number 220, and

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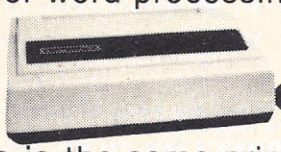
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RUN 1

```
Do you want to use the built in function or list your own
     data, F or L ? F
If you use Simpson's Rule you must use an even number of
     subareas, that is, an odd number of y values.
Are you using the Trapezoidal or Simpson's Rule, T or S ? T
How many subareas do you want (up to 1000) ? 200

******  THE AREA IS  .9999948

You have just computed the area under a sine curve from
     zero to pi. The correct answer is 1.0.

     ******  THE RELATIVE ERROR IS  .00052 %
```

RUN 2

```
Do you want to use the built in function or list your own
     data, F or L ? F
If you use Simpson's Rule you must use an even number of
     subareas, that is, an odd number of y values.
Are you using the Trapezoidal or Simpson's Rule, T or S ? S
How many subareas do you want (up to 1000) ? 20

******  THE AREA IS  1.0000002

You have just computed the area under a sine curve from
     zero to pi. The correct answer is 1.0.

     ******  THE RELATIVE ERROR IS  -.00002 %
```

RUN 3

```
Do you want to use the built in function or list your own
     data, F or L ? L
If you use Simpson's Rule you must use an even number of
     subareas, that is, an odd number of y values.
Are you using the Trapezoidal or Simpson's Rule, T or S ? T
We will assume the x values are evenly spaced. If this is
     not so, the program must be modified.
What is the value of delta x ? .1
How many values for y, (2 to 1000)? 11
Value number  1 ?0
Value number  2 ?10
Value number  3 ?0
Value number  4 ?10
Value number  5 ?0
Value number  6 ?10
Value number  7 ?0
Value number  8 ?10
Value number  9 ?0
Value number  10 ?10
Value number  11 ?0

******  THE AREA IS  5
```

RUN 4

```
Do you want to use the built in function or list your own
     data, F or L ? L
If you use Simpson's Rule you must use an even number of
     subareas, that is, an odd number of y values.
Are you using the Trapezoidal or Simpson's Rule, T or S ? S
We will assume the x values are evenly spaced. If this is
     not so, the program must be modified.
What is the value of delta x ? .1
How many values for y, (2 to 1000)? 11
Value number  1 ?0
Value number  2 ?10
Value number  3 ?0
Value number  4 ?10
Value number  5 ?0
Value number  6 ?10
Value number  7 ?0
Value number  8 ?10
Value number  9 ?0
Value number  10 ?10
Value number  11 ?0

******  THE AREA IS  6.6666667
```

making suitable modifications to the remarks in 370 and 380. In addition, the guts of either method may be extracted from NUMERINT and used as a subroutine in a program of the reader's choice.

COMPARISON OF METHODS

It is obvious at the outset that if an analytic function composed of straight lines is integrated using the Trapezoidal Rule, the result will be an exact answer, which could be equaled but not improved upon by Simpson's Rule. On the other hand, if the function were in fact composed of second degree parabolas, Simpson's Rule would deliver an exact solution, which the Trapezoidal Rule could not equal. It follows, therefore, that Simpson's Rule is not automatically more accurate than the Trapezoidal Rule. It certainly requires slightly more running time. The Trapezoidal Rule, on occasion, may therefore be faster and just as accurate.

In the case where numerical values are available only at certain discrete intervals, such as stock market data, certain purists may take the position that any attempt to bridge the open spaces with any-

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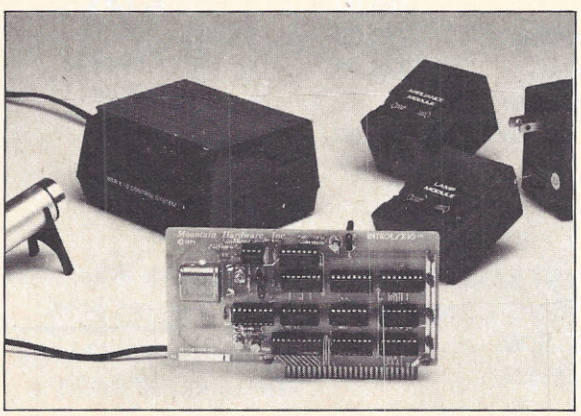
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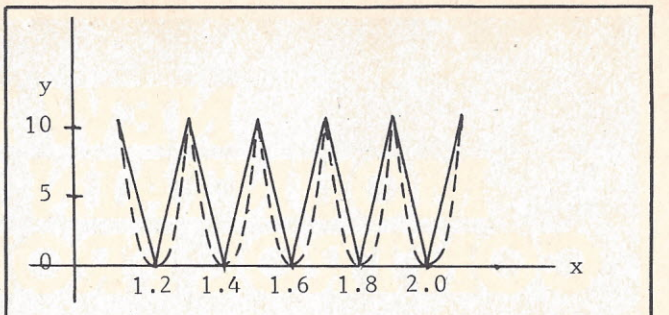


Figure 6.

thing more than a straight line cannot be justified. Under such circumstances, the added complication of Simpson's Rule is not warranted. In the case of Programs 4YESERES and 4YEANAL, the Trapezoidal Rule was used since it was desired to use stock prices no more than one day apart, since the periods under investigation might have been that short. With such a tight network of data, it was felt that the Trapezoidal Rule was sufficient.

In general, however, Simpson's Rule will provide a given level of accuracy with a much smaller number of subareas, and therefore is to be preferred.

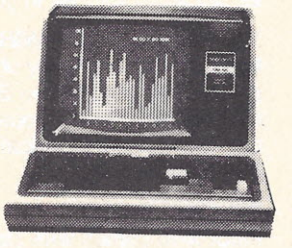
SAMPLE RUNS

Runs 1 and 2, made on the sine function built into Program NUMERINT reveal the extent to which Simpson's Rule can give much more accurate results than the Trapezoidal Rule with only a very few data points. Note that Run 1 was made using the Trapezoidal Rule, and with the interval from 0 to $\pi/2$ divided into 200 subareas. The resulting answer had a relative error of .00052%. Run 2 was made using Simpson's Rule, with the interval from 0 to $\pi/2$ divided into only 20 subareas; yet the result had a relative error of only .00002%. Simpson's Rule delivered 1/26th of the error, using only 1/10th as many calculations. In this type of situation, Simpson's Rule is very much faster than the Trapezoidal.



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Another pair of runs, made on the function shown by the solid lines in Figure 5, reveals the other side of the coin. In this case the Trapezoidal Rule gives the correct answer when only the peaks and the valleys of the function are used (because the function is linear in between), see Run 3. Simpson's Rule, however, attempts to put a parabola between each triplet of points, see the dashed lines in Figure 5, and thus gives an area that is too large, see Run 4.

If the area is divided more finely when using Simpson's Rule, refer to the points at y=5 in Figure 5, the parabolas are straightened out (a straight line is a special case of a parabola) and Simpson's Rule gives a correct answer, see Run 5. If we change the interval of integration in Figure 5 by one half period, see the solid lines in Figure 6, we can again induce Simpson's Rule to give an erroneous answer. This time Simpson's Rule will assume the dashed lines in Figure 6 and give an area that is too small, see Run 6.

To make matters even worse, observe Figure 7. Here the solid lines represent the function of Figure 5 with the interval of integration shifted by one quarter period. If we use the points at y=0, 5 and 10, as indicated in the figure, Simpson's Rule will pass parabolas through the points, in triplets, as shown by the dashed lines.

Even though this is not the correct function, the area given by Simpson's Rule is correct, see Run 7. This is because the area under the first three points is too large, but the area under the second triplet (points 3, 4 and 5) is too small by a compensating amount. This continues throughout the integration. In this case Simpson's Rule commits two compensating errors and thus staggers up with the right answer, but for the wrong reason.

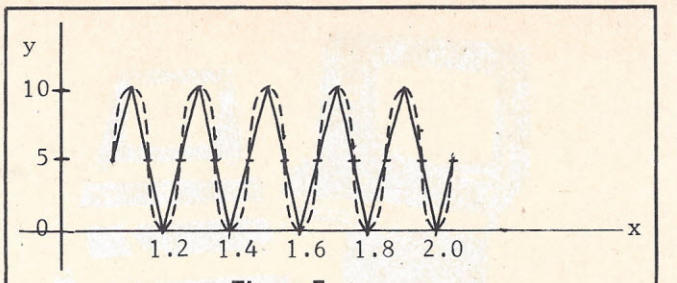


Figure 7.

CONCLUSIONS

It is apparent from the above that under most normal circumstances Simpson's Rule gives a much more accurate answer in much less time than the Trapezoidal Rule. However, the use of Simpson's Rule may, under some circumstances, provide no advantage; and may even under the right circumstances permit the inattentive and the unwary to blunder in grand style.□

RUN 5

```
Do you want to use the built in function or list your own
      data, F or L ? L
If you use Simpson's Rule you must use an even number of
      subareas, that is, an odd number of y values.
Are you using the Trapezoidal or Simpson's Rule, T or S ? S
We will assume the x values are evenly spaced. If this is
      not so, the program must be modified.
What is the value of delta x ? .05
How many values for y, (2 to 1000)? 21
Value number  1 ?0
Value number  2 ?5
Value number  3 ?10
Value number  4 ?5
Value number  5 ?0
Value number  6 ?5
Value number  7 ?10
Value number  8 ?5
Value number  9 ?0
Value number  10 ?5
Value number  11 ?10
Value number  12 ?5
Value number  13 ?0
Value number  14 ?5
Value number  15 ?10
Value number  16 ?5
Value number  17 ?0
Value number  18 ?5
Value number  19 ?10
Value number  20 ?5
Value number  21 ?0

******  THE AREA IS  5
```

RUN 6

```
Do you want to use the built in function or list your own
      data, F or L ? L
If you use Simpson's Rule you must use an even number of
      subareas, that is, an odd number of y values.
Are you using the Trapezoidal or Simpson's Rule, T or S ? S
We will assume the x values are evenly spaced. If this is
      not so, the program must be modified.
What is the value of delta x ? .1
How many values for y, (2 to 1000)? 11
Value number  1 ?10
Value number  2 ?0
Value number  3 ?10
Value number  4 ?0
Value number  5 ?10
Value number  6 ?0
Value number  7 ?10
Value number  8 ?0
Value number  9 ?10
Value number  10 ?0
Value number  11 ?10

******  THE AREA IS  3.3333333
```

RUN 7

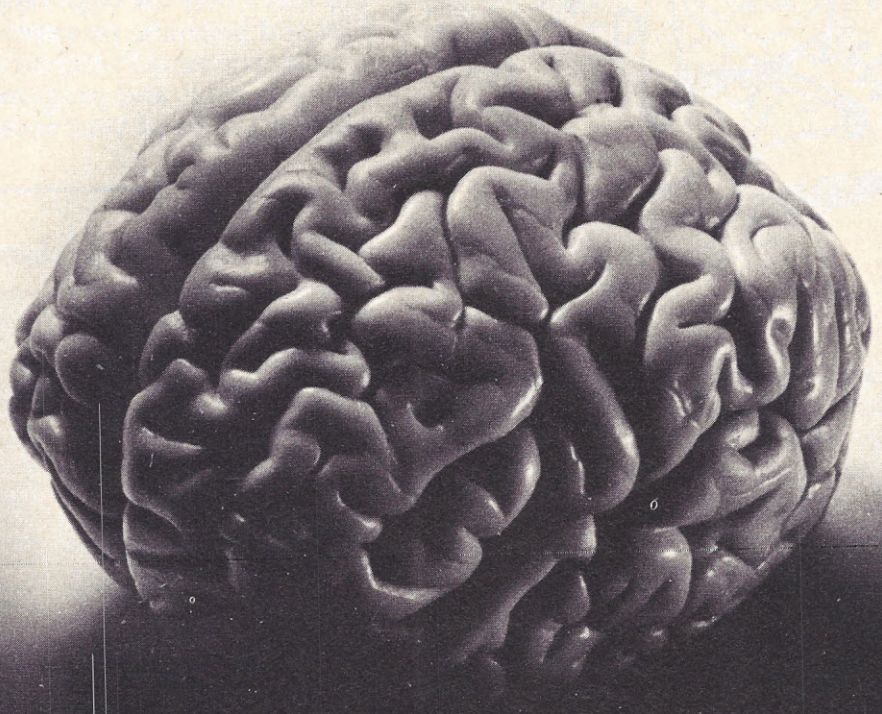
```
Do you want to use the built in function or list your own
      data, F or L ? L
If you use Simpson's Rule you must use an even number of
      subareas, that is, an odd number of y values.
Are you using the Trapezoidal or Simpson's Rule, T or S ? S
We will assume the x values are evenly spaced. If this is
      not so, the program must be modified.
What is the value of delta x ? .05
How many values for y, (2 to 1000)? 21
Value number  1 ?5
Value number  2 ?10
Value number  3 ?5
Value number  4 ?0
Value number  5 ?5
Value number  6 ?10
Value number  7 ?5
Value number  8 ?0
Value number  9 ?5
Value number  10 ?10
Value number  11 ?5
Value number  12 ?0
Value number  13 ?5
Value number  14 ?10
Value number  15 ?5
Value number  16 ?0
Value number  17 ?5
Value number  18 ?10
Value number  19 ?5
Value number  20 ?0
Value number  21 ?5

******  THE AREA IS  5
```

PROGRAM LISTING

```
30 REMIIIIIIIIIIIIIII  P r o g r a m    N U M E R I N T  IIIIIIIIIIIIII
70 REMIIIIIIIIIIIIIII  Version  1.0  -  December  1979  IIIIIIIIIIIIII
80 REM
90 DIM V(1001)
95        REM ****** INPUT DATA
100 !"Do you want to use the built in function or list your own"
110 INPUT"       data, F or L ? ",D$
120 !"If you use Simpson's Rule you must use an even number of"
130 !"       subareas, that is, an odd number of y values."
140 INPUT"Are you using the Trapezoidal or Simpson's Rule,
    T or S ? ",R$
150 IF D$<>"L" THEN 420
155       REM ****** USE EXTERNAL FUNCTION
160 !"We will assume the x values are evenly spaced. If this is"
170 !"       not so, the program must be modified."
180 INPUT"What is the value of delta x ? ",X1
190 INPUT"How many values for y, (2 to 1000)? ",T9
192 IF R$="S" THEN IF T9/2=INT(T9/2) THEN GOTO 120
195       REM ****** NUMERICAL INTEGRATION DATA
200 FOR T=1 TO T9
210 IF D$="L" THEN 240
215       REM ****** BUILT IN FUNCTION
220 V(T)=SIN((T-1)*X1)
230 GOTO 250
235       REM ****** EXTERNAL FUNCTION
240 !"Value number ",T," ",\INPUT V(T)
245       REM ****** INTEGRATION
250 IF T>1 THEN 280
260 A1=V(1)
270 GOTO 320
280 IF T<T9 THEN 302
290 A1=A1+V(T9)
300 EXIT 325
302 IF R$="T" THEN 310
305 IF T/2=INT(T/2) THEN 315
310 A1=A1+2*V(T)
312 GOTO 320
315 A1=A1+4*V(T)
320 NEXT
325 IF R$="T" THEN 330
326 A=A1*X1/3
327 GOTO 340
330 A=A1*X1/2
335       REM ****** PRINT RESULTS
340 !\!"******  THE AREA IS ",A
350 IF D$="L" THEN 400
360 E=(1-A)*100
370 !\!"You have just computed the area under a sine curve from"
380!"       zero to pi. The correct answer is 1.0."
390 !\!"       ******  THE RELATIVE ERROR IS ",E," %"
400 !\!
410 END
415       REM ****** USE BUILT IN FUNCTION
420 INPUT"How many subareas do you want (up to 1000) ? ",S9
425 IF R$="S" THEN IF S9/2<>INT(S9/2) THEN GOTO 120
430 X1=1.5707963/S9
440 T9=S9+1
450 GOTO 200
```

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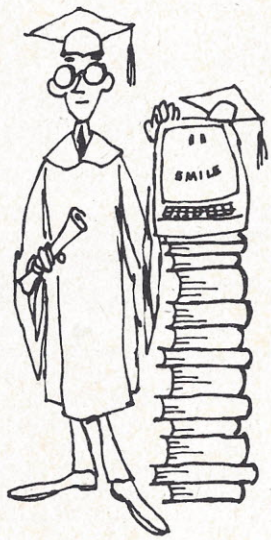


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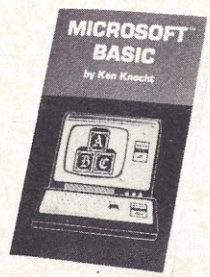
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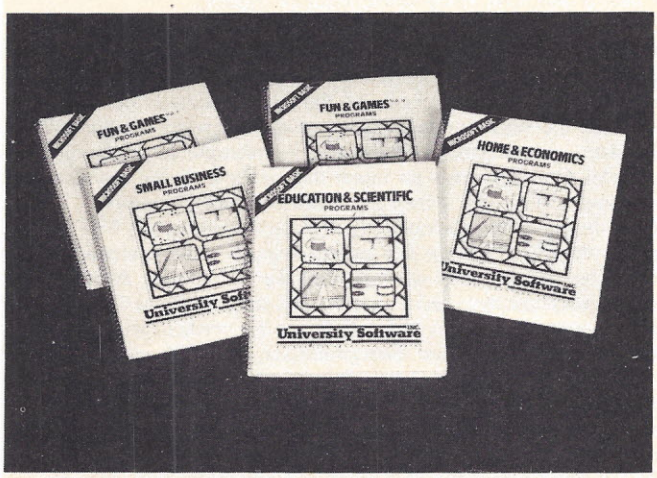
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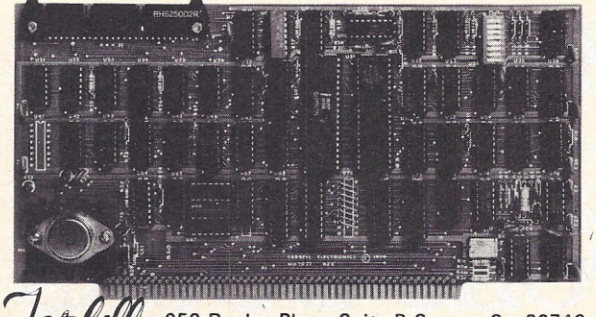
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THE MIND REVOLUTION

By Merl Miller

The views and opinions in this column are those of the author and not necessarily those of the magazine or its staff.

Last month I mentioned that we were going to take a slightly different approach in this column. Instead of focusing on artificial intelligence alone, the emphasis would shift to the future aspects of technology. Before we can really understand the future, we must understand something about the past; so we will go into the distant past (for microcomputers) to 1970. This is a good starting point because the last decade probably was the start of the second industrial revolution. Just as the steam engine freed man from mundane physical labor, the microprocessor will free man from mundane mental labor.

An important point must be made here about microprocessors. The microprocessor is a product of the semiconductor industry, and consequently the microcomputer is an outgrowth of the semiconductor industry — not the computer industry. Until Hewlett-Packard came out with its HP-85 in January of 1980, no large computer company had a competitive entry in the field. To get a clear picture of what has happened in this field, and what is likely to happen, we will take a brief look at the semiconductor industry.

The integrated circuit was developed by Texas Instruments in the late 1960's. As a result of this new technology, called large scale integration, a variety of sophisticated applications were developed. The most important was, of course, the microprocessor; but development of the microcomputer was just as dependent on another application — semiconductor memory. The microprocessor changed the digital design process so much that semiconductor manufacturers began to wonder if they could sell compatible memory.

Even though Intel developed the first microprocessor in 1971, it wasn't until 1975 that the first microcomputer was developed by MITS. This development was due partially to memory. Although many microcomputers used a variety of 1K static RAMs in 4K or 8K configurations, there was a real push to use the newly developed 4K dynamic RAMs. Intel's third microprocessor, the 8080, quickly became the small computer standard, but before long, Zilog's Z-80 started to take over the market. The Z-80 now dominates the small computer market — partially due to Radio Shack choosing it for the TRS-80.

All this has come about as a result of some really innovative advances in circuit technology. Things like integrated injection logic and ion implantation have had, and will have, significant impact. You might ask what all this "ion-whatever" has to do with it. I think I can illustrate the importance of these things with a simple example.

In 1972 Professor Nick Holoynak of the University of Illinois showed me a little blue card with red arrows on it that demonstrated a new technology. This new technology, developed at Bell Lab by some of his former students, was simply referred to as magnetic domains, or later as magnetic bubbles. Magnetic bubble memory is currently the "hottest" new enhancement to small computers.

It took nine years for it to reach a point of acceptance, so the time lag is significant. If we keep a close watch on all developments such as this in the semiconductor industry, we may be able to develop some useful theories about future development.

Technological advances are not controlled solely by the development of new technology. Economics can be more important than technology. The shakeout in the microcomputer industry has

already begun as many pioneer companies find it tough going and go out of business. These considerations will become increasingly important as all segments of the industry grow.

Semiconductor manufacturers have made their money by designing microprocessors and other devices that are suitable for a variety of applications, the microcomputer being just one of these. The microprocessor in a $600 microcomputer costs the manufacturer less than $20. No semiconductor manufacturer could survive on that alone.

This summary of some of the developments of the 70's is at best very sketchy, but hopefully it gives us a starting point. I had planned to stop with this simple discussion, and leave the future for other installments; but let me diverge into something I have a great deal of interest in.

You have probably heard or used the expression, "My mind was a total blank." This is, of course, impossible. We are always thinking of something. Have you ever tried thinking of nothing? It is kind of strange. If you have never tried it, do it now. What do you "hear"? . . .a variety of little voices saying, "I'm not thinking of anything."

Psychologists disagree about what is actually going on, but they do agree that there is some kind of electrical activity. This electrical activity can be measured by a device called an EEG. But the EEG won't tell you anything about the electrical activity, just that it is happening. This happens much the same way that an oscilloscope tells you that a computer is producing signals.

It has always been my theory that the human brain operates in some combined analog/digital mode that is traceable. If it is traceable, it should be decipherable. If we can decipher it, we can use it. Imagine the capabilities a person would have if there could be a direct mind to computer link. Let's just use one example.

If a paraplegic could be connected to this kind of device, he could function entirely on his own. Imagine what it could mean to mankind. Take the example of the brilliant physicist Stephen Hawkins. He helped develop many of the theories about black holes, yet he has cerebral palsy, and can barely speak — let alone make himself understood. His contribution to mankind has already been enormous, but it could be enhanced by this kind of communicative link.

There are a myriad of other applications, and there are some moral and ethical questions that need to be addressed; but I'll leave all of that to another time.□

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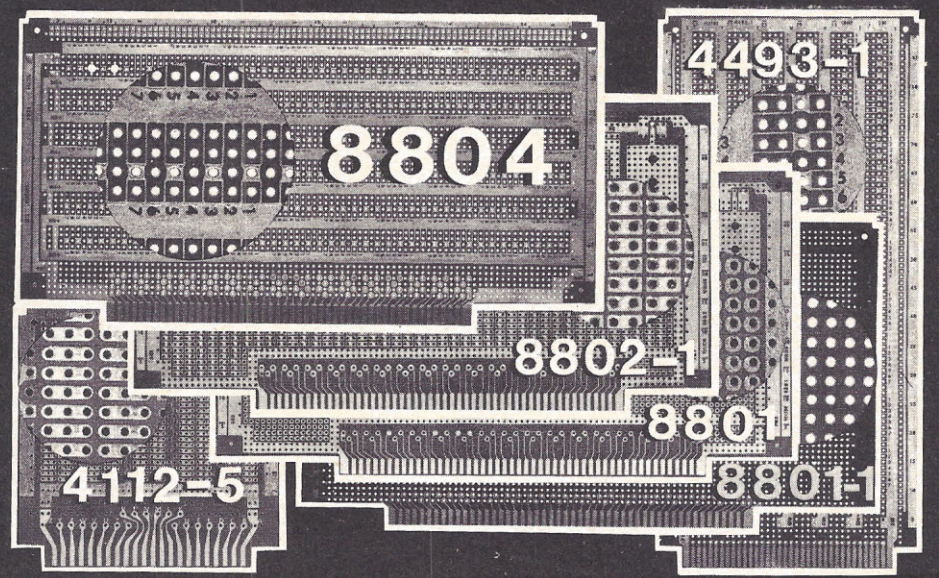
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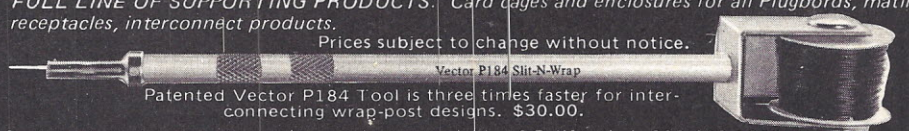


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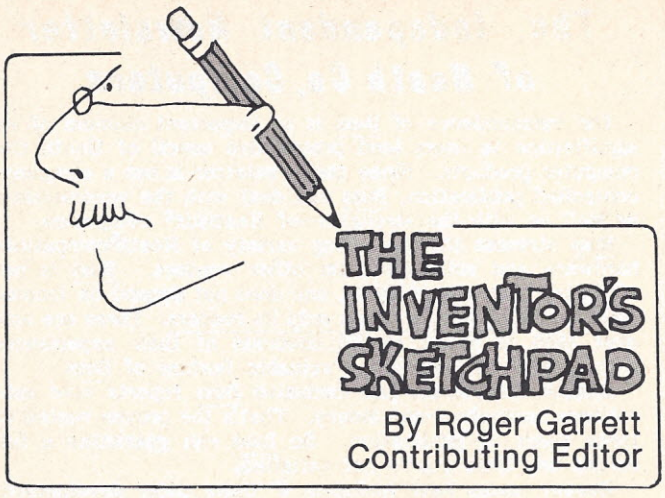
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By Roger Garrett
Contributing Editor

WHAT'S A FEINBERG?

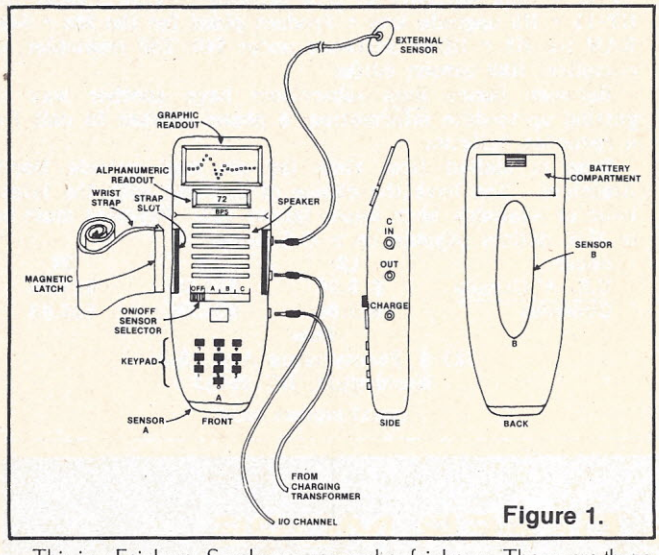


Figure 1.

This is a Feinberg. Surely you remember feinbergs. They were those little handheld all-purpose medical diagnostic tools which Dr. McCoy would hold over his patients on the Enterprise for a few seconds, look at the readout, and confidently prescribe a cure. While this one is not all-purpose and is not quite as small as those miniature salt shakers used by McCoy (and by the way, they *were* actually salt shakers) it does fulfill a medical need and only requires currently available technology. Essentially it is an intelligent stethoscope.

At the top is a graphic readout made of 32 by 64 element LED array. Similar, albeit smaller, arrays are used on the multitude of electronic games which invaded the U.S. last Christmas. This is used to display the heartbeat as a time/amplitude graph just as it would appear on the CRT or strip chart of an electrocardiograph. The microprocessor controller would appropriately scale the graph so it is most easily read and could also position it so that the major amplitude spike always appears near the center, rather than moving across the display as with an EKG.

Below the graphic display is an alphanumeric readout with perhaps a six character capacity. In normal use this would simply display the heartbeat rate as beats per second (hence the "bps" below the display). This function is easily handled by the microprocessor by taking the average time between beats for the last several beats.

The speaker in the center of the device does not, as you might expect, provide an amplified output of the heartbeat. The doctor or nurse can "see" the heartbeat on the graphic display so there is no need to hear it. Indeed, more information can be gleaned from looking at a visual representation of the heartbeat than from listening to its sound. Rather the speaker is used as an alert device. More on that in a moment.

The ON/OFF/SENSOR SELECTOR switch allows the user to select one of three input sensors, i.e. he selects where the heartbeat sound is coming from. There are three possible sources. Sensor A is at the bottom of the unit and sensor B is on the back. When C is selected, it means the sound information is coming in from an external sensor plugged into the side of the unit. Each of these sensors is essentially a microphone. The unit contains a simple amplifier circuit and an analog-to-digital converter to change the sound wave form of the heartbeat into appropriate digital form for use by the internal microprocessor.

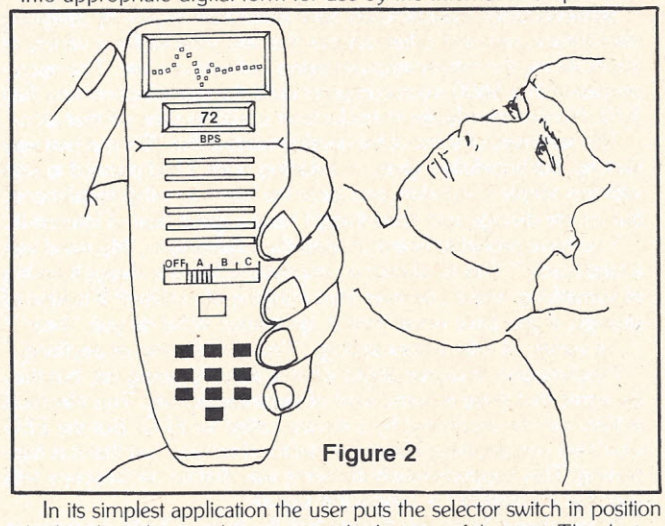


Figure 2

In its simplest application the user puts the selector switch in position A, thereby selecting the sensor at the bottom of the unit. The device is held in the hand as shown here and the sensor is pressed against one of the patient's pulse points such as the upper left rib cage just over the heart or the wrist. The graphic display comes on immediately and in a few moments the bps display shows beats per second.

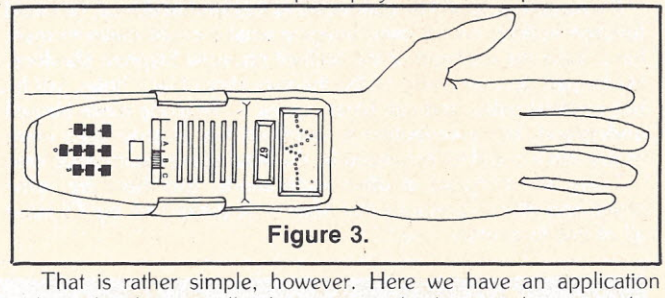


Figure 3.

That is rather simple, however. Here we have an application where the device really shows its worth. Assume the patient has been in an accident, or is susceptible to heart attacks, or for any other reason requires *constant* monitoring of his heart. We simply select sensor B (on the back of the unit) and strap it to his wrist. We don't have to keep looking at the readouts because the unit itself monitors the heartbeat. Remember that we have a microprocessor inside there. It requires only a relatively simple piece of software (easily implemented in ROM) to detect danger conditions such as weak pulse, lost pulse, B-frib (that's when the heart flutters instead of beating), and so forth. *That's* what the speaker is for. It is used to signal the doctor or nurse that a danger condition has occurred. Each condition has a unique tone or series of tones associated with it so that the doctor can immediately recognize the symptom without constantly monitoring the patient's heartbeat himself. Perhaps the danger condition could even be spoken by the device since voice output technology is currently available at reasonable cost.

Now what do you suppose that little keypad is for at the bottom of the unit? Let's give one of these devices to the nurse as he makes his rounds to the hospital wards. At each patient he has to take their pulse and record it on the chart. That's what is done now, but it's slow and tedious and more and more hospitals are keeping patients' records on computers rather than on handwritten charts. With our device the nurse types in the patient's I.D. number via the keypad, holds the sensor portion on the patient's wrist for half a minute or so, and goes on to the next patient. The unit remembers everyone's readings and when the nurse gets back to the records department he plugs it into the computer, via the I/O channel on the right side of the unit, and all of the readings are transferred to the appropriate patient's records.

These units should be inexpensive enough ($20 to $30 I would expect) that individuals could own their own. A person susceptible to heart problems could keep one in his pocket with an external sensor pasted to his chest over his heart. He could then have constant monitoring and would easily know when he is over-exerting himself.

Since this feinberg requires only readily-available hardware and relatively simple software, all that is necessary now is for some community-minded company to invest some development funds and get it into production.□

The new name in business microcomputers. The trusted name in quality. Zenith Data Systems.



Zenith Quality. Zenith, a company dedicated to providing quality, trouble-free products is now committed to developing and supporting a full line of soundly-engineered, affordably-priced microcomputer business systems.

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Zenith Data Systems, another example of why at Zenith "the quality goes in, before the name goes on."

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ZENITH

data systems

Advertising with the Apple Computer



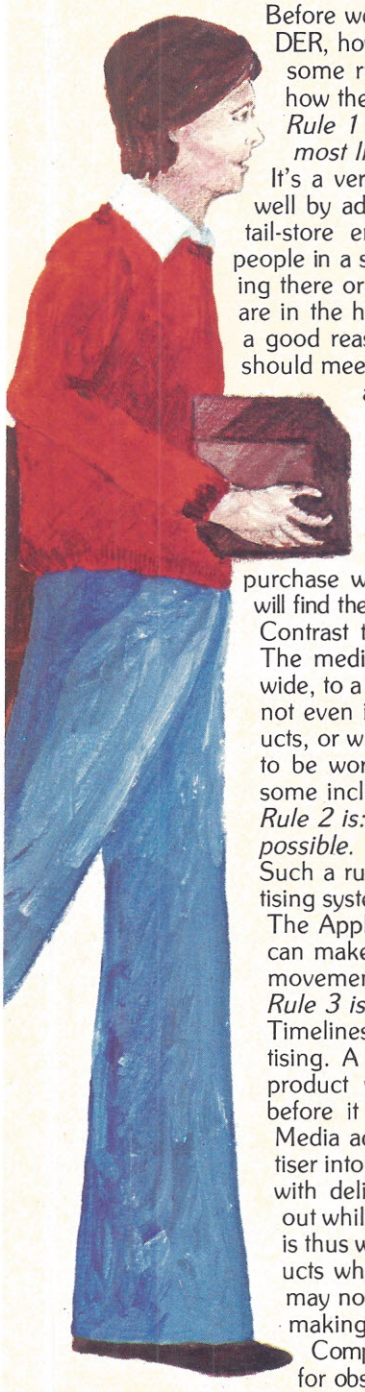
By Howard H. Rothman
Connecticut Information Systems Co.
218 Huntington Road, Bridgeport, CT 06608

Imagine walking past a shop window and seeing a large color TV in the window. The TV is broadcasting the following message in big, colorful letters: **Stop! We have gorgeous bathing suits on sale today! Get one before they're gone!** Next, imagine that the ad disappears and you see a model, wearing a bathing suit, plunge into a wave at the beach. A moment later, the swimming model disappears and an on-screen message announces a sale on shoes tomorrow. The ads continue and, sooner or later, you're tempted, and walk into the store.

You have just experienced the possibilities of advertising opened up by the personal computer. Such computers, with excellent graphics capabilities, like the Apple, are now available, and storekeepers, trade-show exhibitors, hotels, etc. can use them for advertising. The possibilities are limitless. However, it would be nice to see a sample of such advertising firsthand, to appreciate the potential.

This article describes a simple advertising program which Connecticut Information Systems Company sells for the Apple computer. It's called the SCROLLING WONDER, and it illustrates several important advertising concepts.

Illustration by Samantha Lee



Before we discuss the SCROLLING WONDER, however, it might be wise to explore some rules of advertising, to understand how they are embodied into the program.

Rule 1 is: Expose ads to those who are most likely to buy.

It's a very simple rule, and it is observed well by advertising via a computer in a retail-store environment. The reason is that people in a shop are either in the habit of buying there or are considering doing so. If they are in the habit of buying there, giving them a good reason to make one more purchase should meet with little sales resistance. If they are simply considering a purchase, it is easier to conclude the buying at that particular site than to go elsewhere.

Even if the ads are broadcast to passers-by, via color TV sets in store windows, the probability of purchase will be high, just because people will find the purchasing outlet so close at hand.

Contrast the computer ad with media ads: The media broadcast the message far and wide, to a vast audience, many of whom are not even interested in the store or its products, or who might find the store too distant to be worth traveling to, even if they had some inclination.

Rule 2 is: Make ads as attention-getting as possible.

Such a rule is again observed by an advertising system based on the Apple computer. The Apple can draw pictures in color and can make them move. Pictures, color and movement all help to attract attention.

Rule 3 is: Make ads timely and accurate.

Timeliness is especially important in advertising. A storekeeper should advertise his product when it is on his shelves, not before it arrives, or after it is exhausted. Media ad schedules often lock the advertiser into a timetable that does not coincide with delivery. Moreover, items often sell out while ads are still running, and money is thus wasted there too. In addition, products which are "fresh" when they arrive may no longer be fresh several days later, making the ads inaccurate.

Computer-based ads have the potential for observing Rule 3 much more readily, because the ads needn't be displayed by the storekeeper until the goods arrive. Also, the ads can be instantly terminated when the shelves empty. Moreover, as the condition of the remaining merchandise changes with time, the ads can be effortlessly altered both with respect to price and description.

An additional point worth considering is that the storekeeper has complete control over ads at all times so as to prevent errors and omissions.

SCROLLING WONDER

First, it should be pointed out exactly what the SCROLLING WONDER does. It takes up to four brief slogans and "pops" them onto the screen from below. The slogans are popped on in random order, with random vertical spacing between them, random placement from side-to-side, and they flash at random.

The slogans drive upward, and create an impression similar to bubbles rising to the top of a fish tank. Since the letters employed here are standard Apple characters, they are too small to be seen from a distance. Thus, this program cannot be effectively used in shop windows, but it works well inside, especially at points of sale, i.e., cash registers.

At the cash register, the customer stands right near the screen, and sees the messages easily. If the messages urge him to pick up extra items before leaving the store, he often will do so. The ad system creates the buying impulse.

The ad system illustrates Rule 1: Ads are presented to those most likely to buy. In this case, the ad viewer is someone standing at the cash register with his money ready.

Next, the ads are attention-getting, illustrating Rule 2. They are moving, and therefore are eye-catching. Moreover, they are presented randomly. The viewer doesn't realize that there are only four ads. He usually watches at least a dozen presentations before he appreciates that they are repetitive.

Third, the colorful "grand finale," which is interposed between runs of slogans, serves to again attract the viewer's attention if he has tired of the slogans. He thinks that something new is starting, but actually it's a prelude to another batch of similar slogans. Nevertheless, the prelude causes the viewer to briefly pay attention when the slogans resume, proving the attention-getting character of this program.

Statements 194 through 200 are the "meat" of the program. They are the actual statements which print the ads.

The SCROLLING WONDER is a simple program, and does not begin to explore the full potential of computer-based advertising, which is only in its infancy. The sole place in the United States where its advantages are presently applied and widely appreciated is at Times Square in New York City. There, a giant electric sign (composed of colored light bulbs) high up on a skyscraper broadcasts images and messages to thousands of viewers each day.

Every imaginable type of goods and services is advertised, from Broadway shows to airline flights to liquor and TV sets. The advertisers presumably find such ads highly profitable, since the same ones use the service year after year. The computer controlling the displays is a small mini produced by DEC.

There is no reason why computers cannot perform the same service for small businesses. It only requires enterprising programmers to produce the software.□

Program follows

PROGRAM LISTING

```
 2 CALL -936: TEXT : VTAB 1
 4 DIM SAY1$(255),SAY2$(255),SAY3$
   (255),SAY4$(255)
 5 INPUT "PLEASE TYPE YOUR STATEMEN
   T AND HIT RETURN: ";SAY1$: PRINT

 6 INPUT "PLEASE TYPE STATEMENT #2
   AND HIT RETURN: ";SAY2$: PRINT

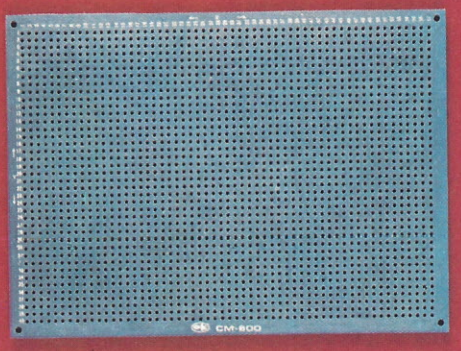
 7 INPUT "PLEASE TYPE STATEMENT #3
   AND HIT RETURN: ";SAY3$: PRINT

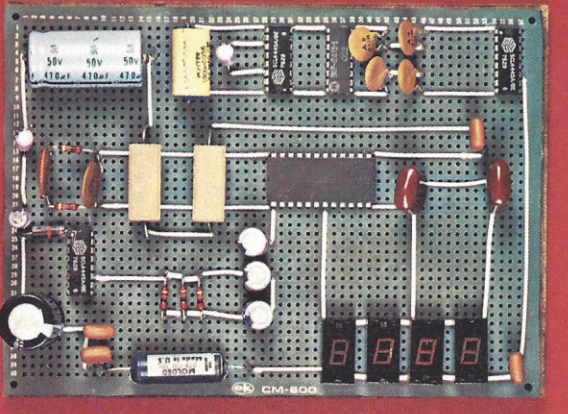
 8 INPUT "PLEASE TYPE STATEMENT #4
   AND HIT RETURN: ";SAY4$: CALL
   -936
10 QUICK3= ABS ( RND (40- LEN(
   SAY3$))):QUICK4= ABS ( RND
   (40- LEN(SAY4$)))
11 QUICK1= ABS ( RND (40- LEN(
   SAY1$)))
12 QUICK2= ABS ( RND (40- LEN(
   SAY2$)))
13 G= RND (2): IF G=1 THEN POKE
   50,127
14 CHCE= RND (4): IF CHCE=1 THEN
   300
15 CHCE= RND (4): IF CHCE=2 THEN
   310
16 CHCE= RND (4): IF CHCE=3 THEN
   320
20 TAB (QUICK1+1): PRINT SAY1$

35 POKE 50,255
36 TIMES= RND (5)
37 FOR X=1 TO TIMES
38 PRINT
39 NEXT X
41 PAUSE=0
42 PAUSE=PAUSE+1
44 IF PAUSE<200 THEN GOTO 42
50 COUNT=COUNT+5
60 IF COUNT>200 THEN GOTO 100
70 GOTO 10
100 COUNT=0: GR
105 FOR V1=0 TO 39
110 HUE= RND (16)
112 COLOR=HUE
113 IF HUE=0 THEN GOTO 110
120 HLIN 0,39 AT V1
130 NEXT V1
160 FOR H1=0 TO 39
170 HUE= RND (16)
172 COLOR=HUE
175 IF HUE=0 THEN GOTO 170
180 VLIN 0,39 AT H1
190 NEXT H1
191 NUM=NUM+1
192 IF NUM<6 THEN GOTO 105
193 NUM=0

194 TAB ((40- LEN(SAY1$))/2): PRINT
    SAY1$
195 TAB ((40- LEN(SAY2$))/2): PRINT
    SAY2$
196 TAB ((40- LEN(SAY3$))/2): PRINT
    SAY3$
200 FOR T=1 TO 1500: NEXT T: TEXT
    : CALL -936: GOTO 10
300 TAB (QUICK2+1)
302 PRINT SAY2$
304 GOTO 35
310 TAB (QUICK3+1)
312 PRINT SAY3$
314 GOTO 35
320 TAB (QUICK4+1)
322 PRINT SAY4$
324 GOTO 35
```

CM-600 Circuit Mount







CM-600 $6.95*
RW-50 $2.98*

NEW CM-600 SOLDERLESS PROTOTYPE BOARD

CM-600 is a unique system for solderless construction of circuit prototypes, useful to both engineers and hobbyists. The CM-600 is a neoprene board 4½" (114mm) x 6" (152mm) with 2280 holes on .100" (2.54mm) centers. Standard components including DIP's are mounted by simply inserting leads into the holes in the long life neoprene material. Interconnections are easily made using 20 or 22 AWG (0,8 or 0,65mm) wire jumpers. Positive contact is assured by the elasticity of the hole, which compresses the leads together. To remove components or leads, simply pull out. This facilitates easy circuit changes making it ideal for breadboarding experimental circuits. CM-600 also features numbered rows and columns for easy reference.

Accessory Kit RW-50 contains 50 pcs of AWG 20 (0,8mm) insulated jumper wires of assorted lengths from ½" (13mm) to 4" (100mm). Both ends are stripped and bent 90° for easy insertion. In stock directly from

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*Minimum billings $25.00, add shipping charge $2.00
New York State residents add applicable tax



By Charles J. Jacobus

Although I use my microcomputer for business accounting, I have often wished I had an effective word processor. But I have not been able to justify the cost of about $1,000 to buy one for my limited use.

So in my spare time I worked on the program RPTWORD, which is designed to word process ASCII saved, program format word files.

WRITING AND EDITING THE TEXT

Instead of developing an intricate word input program or routine with provisions for adds, deletes, moves, editing, etc., I simply create my text using program writing format. In other words, in AUTO or by hand, I number each line of text, type a quote mark to hold all lower case and punctuation in place, and then type text.

Usually at the time of writing I insert the printing format symbols used by the report writing program, but these can be added or cleaned up in the editing process, too. Using this method of text preparation I have all the power of MITS BASIC program editing at my disposal.

The report writing, RPTWORD, inputs lines of text from the disk file as A$, and concatenates A$ to the back of B$. The first 60 characters (or less if the line is indented) of B$ are processed for printing.

Since in MITS BASIC strings are limited to 255 characters, the length of the B$ + A$ must always be less than 255 or an Out of String Space Error will result. Therefore, the typed input strings, later to be handled by RPTWORD as A$, must be less than 255 – 60 = 195 characters long.

As a practical matter, if you type on an 80 width screen, two lines of typing per program line number works well and occasionally you can afford to spill half way into the third line. But if you crowd too much, you have no room to add text inside a line using the EDIT command, and you may have to move part of the sentence to a new line number.

Although it is often convenient to type a single sentence to a program line number, that is not necessary. RPTWORD does not care whether input strings (A$) are complete sentences. It always inserts a null space between the B$ and the A$ when it joins them.

Another advantage of this system, besides its simplicity, and the power of the MITS BASIC editing tools, is the ability to LIST or LLIST the text entirely or by groups of line numbers for editing. If the text is long, it will be best to LLIST it so line numbers and format symbols appear.

A REALLY SHORT AND SIMPLE WORD PROCESSOR

Another alternative is to make a choice in RPTWORD to print the text as it will appear in final form except the text line numbers appear in the right margin. Figure 1 shows an edited text. This is particularly helpful at a final stage to spot errors in the formatting symbols of the text.

ORGANIZING THE TEXT FILES

The amount of text you may have in one disk file will be limited by the size of your memory. My MITS 8080b has 56K, and about 20K of that holds BASIC. So each file of text I type has to be less than 36K. This entire article only took about 10K, but suppose you write something longer, like a book? In that case it is better to make each chapter a file, and give them file names such as A1, A2, A3, etc., in the order they will appear in the text.

RPTWORD is presently designed to go to successive chapter files as required. The program will take any legal file name (eight characters) for a single file job, but presently uses the system of a letter followed by up to four numbers for successive or chapter type files. This system is easily changed by the user, and is to be found in the program section 'Next File/Chapter Routine'.

THE REPORT WRITER PROGRAM

RPTWORD prints articles, reports, or letters in the usual format of each. When printing articles or reports, you will want to change the strings F$, G$ and H$ near the beginning of the program to insert your own name and address.

The remarks at the beginning of the program explain the text symbols. Figure 2 is the actual text of a letter employing most of the symbols. That same letter is shown in Figure 3 as it was printed by RPTWORD.

When printing letters, letterheads in either continuous form or single sheets can be used. In the latter case, the program stops each time a single sheet is finished. The closing salutation of a letter is not automatic. It must be typed into the text, but is indented uniformly by using the symbol #. See the examples of letter text format and printed out.

The program turns and numbers pages. It right justifies, if directed, adding additional spaces between words starting at the right end. The program will single space or double space lines as directed by the operator.

The text file disk is put on drive 1, and the address list, if used, is put on drive 0. This arrangement can easily be changed, of course, but my customer, vendor, and chart of account files are all kept on a separate disk.

NAME AND ADDRESS LISTS

The program will address each form letter using a list of names and addresses called by the file name CL$ if put in by the operator when prompted. If letters are to be written by the computer but addressed later by hand, a RETURN entered by the operator when prompted will simply leave space in the printed letter for the name and address.

The address file is another ASCII saved program type file. It is fielded as: 1234 'Customer Name, Address, City, State/zip. See the example customer list, Figure 4, and how it resides on disk. You will see that each customer has a four digit, integer number. I have number groups for customers and vendors set up in alphabetical order. I like to put customer lists, vendor lists and charts of accounts in an ASCII formatted file because they will sort automatically in memory as additions or changes are made, and thereby I save considerable work.

In all fairness I want to tell you one of the minor disadvantages of typing text in program format. Occasionally you will forget to put the quotation mark in after the line number. If that happens, and you save the program/text in ASCII, a Syntax Error will appear when the bad line is reached upon loading. Incomplete loading of the text results. But this situation can be saved by use of the little FIXASCII program. The FIXASCII program is listed with built-in instructions for its use in Figure 5.□

Figures and program follow

```
A REALLY SHORT AND SIMPLE WORD PROCESSOR                    40
                                                            50
By                                                          60
                                                            70
Charles J. Jacobus                                          70
                                                            80
    Although I use my microcomputer for business            80
accounting, I have often wished I had an effective word     90
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                                                            110
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insert the symbols used by the report writing program, but  130
these can by added or cleaned up in the editing process,    140
too. Using this method of text preparation I have all the   140
power of MITS Basic program editing at my disposal. See     140
Insert #1 for an explanation of the MITS Basic editing      140
provisions.                                                 140
```

Figure 1. Example of edited text with file line numbers in margin.

```
10 'FILE NAME "CUSTLETT"
20 "Dear Sirs:&
30 "^It has been a month since HexaDec Equipment Co. sold its
40 "assets to Brown Company,
50 "and your account with us is now over 60 days old.&
60 "^If there is a problem with the account or if your cash situation is such
70 "that your payment is delayed, we would appreciate hearing from you
80 "promptly on it.&
90 "^Our objective, of course, is to obtain full payment of your account as
100 "quickly as possible, and we will most appreciate your early remittance.&
110 "\\#Yours truly,*
120 "#HEXADEC EQUIPMENT CO.&
130 "\\#Charles J. Jacobus*
140 "#President&
150 "CJJ/cc]
```

Figure 2. Text of a letter typed as a program and saved in ASCII.

5-20-79

AIRTHERM MFG CO
BOX 7039
ST LOUIS, MO63177

Dear Sirs:

It has been a month since HexaDec Equipment Co. sold its assets to Brown Company, and your account with us is now over 60 days old.

If there is a problem with the account or if your cash situation is such that your payment is delayed, we would appreciate hearing from you promptly on it.

Our objective, of course, is to obtain full payment of your account as quickly as possible, and we will most appreciate your early remittance.

Yours truly,
HEXADEC EQUIPMENT CO.

Charles J. Jacobus
President

CJJ/cc

Figure 3a. Letter with address and single spacing.

5-21-79

Dear Sirs:

It has been a month since HexaDec Equipment Co. sold its assets to Brown Company, and your account with us is now over 60 days old.

If there is a problem with the account or if your cash situation is such that your payment is delayed, we would appreciate hearing from you promptly on it.

Our objective, of course, is to obtain full payment of your account as quickly as possible, and we will most appreciate your early remittance.

Yours truly,
HEXADEC EQUIPMENT CO.

Charles J. Jacobus
President

CJJ/cc

Figure 3b. Same letter with address omitted.

5-23-79

BULK PETROLEUM CORP
BOX 427
PARK RIDGE, IL60068

Dear Sirs:

It has been a month since HexaDec Equipment Co. sold its assets to Brown Company, and your account with us is now over 60 days old.

If there is a problem with the account or if your cash situation is such that your payment is delayed, we would appreciate hearing from you promptly on it.

Our objective, of course, is to obtain full payment of your account as quickly as possible, and we will most appreciate your early remittance.

Yours truly,
HEXADEC EQUIPMENT CO.

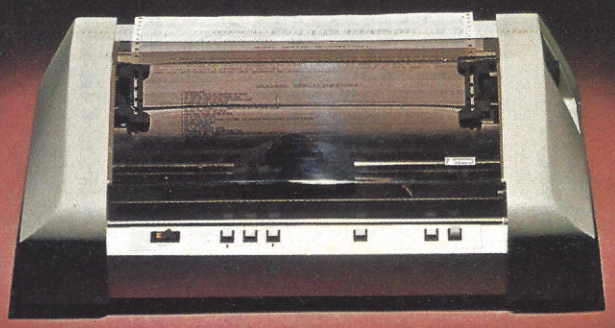
Charles J. Jacobus
President

CJJ/cc

Figure 3c. Same letter with double spacing and right justified.

Meet two new Printers from Anadex:

Resolutionary!



Introducing two totally new alphanumeric line printers from Anadex – Models DP-9500 and DP-9501 – featuring 132/175 or 132/220 columns, respectively.

Both models employ a new, Anadex-manufactured 9-wire print head with 150 million character life (optionally, 650 million) that makes them ideal for high-resolution printing requirements including high-density graphics where print quality and reliability must go hand in hand.

The full standard 96 character ASCII character set, including descenders and underlining of all upper and lower case letters, can be printed bi-directionally on up to 5 crisp copies at speeds up to 200 CPS. Adjustable-width tractors, accommodating paper from 1.75 to 15.6 inches wide, allow the printers to adapt to your application.

The three ASCII compatible interfaces (Parallel, RS-232-C, and Current Loop) are standard in every printer; so interfacing is usually a matter of "plug it in and print." With simplified interfacing, the printers also feature sophisticated communications capability including control of Vertical Spacing (6 or 8 lines/inch), Form Length and Width, Skip-Over Perforation, Auto Line Feed, and full point-to-point communications capability.

Other standard features are a 500 character FIFO buffer (optional, an additional 2048 character buffer), shortest distance sensing logic, self test, and replaceable ribbon cartridge with 6 million character life.

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ANADEX, LTD. • Dorna House, Guildford Road • West End, Woking, Surrey GU24 9PW, England • Tel: Chobham (09905) 6333 • Telex: 858762 ANADEX G

CIRCLE INQUIRY NO. 3

PROGRAM LISTING

```
10 'PROGRAM NAME "RPTWORD" 10/15/78  CHARLES J. JACOBUS - MESQUITE - TX 75149
20 '
30 'A PROGRAM TO PRINT LETTERS OR REPORTS FROM AN ASCII SAVED PROGRAM
40 'TYPE SEQUENTIAL FILE.
50 '
60 'TEXT SYMBOLS: & AT END OF PARAGRAPH-PUTS IN NULL LINE AFTER THIS LINE
70 '              * AT END OF PARAGRAPH-DOES NOT NULL NEXT LINE
80 '              [ AT END OF EACH CHAPTER-TURNS PAGE
90 '              ] AT END OF TEXT-ENDS JOB(END OF LIST ENDS LETTER JOB)
100 '              " AT BEGINNING OF EVERY LINE HOLDS IT LITERAL
110 '              ^ AFTER " INDENTS 5 SPACES-FOR PARAGRAPH START
120 '              % AFTER " INDENTS 8 SPACES-FOR SUB PARAGRAPHS
130 '              # AFTER " INDENTS 40 SPACES-FOR LETTER CLOSINGS
140 '              > AFTER " SPECIAL INDENT AS TYPED-USUALLY ARTICLE HEADINGS
150 '              \ AFTER " PRINTS A NULL LINE.
160 '                THIS SYMBOL CAN BE REPEATED ON THE SAME LINE
170 '                FOR AS MANY NULL LINES AS ARE DESIRED. IT CAN THEN BE
180 '                FOLLOWED BY ONE OF THE INDENT SYMBOLS IF DESIRED.
190 '************************************************************
200 CLEAR 1000:WIDTH 80:ON ERROR GOTO 2120
210 NU=20000 'MAX NUMBER OF LETTERS TO PRINT
220 PRINT:PRINT"WORD PROCESSING REPORT WRITER"
230 PRINT:INPUT"ENTER FIRST FILE NAME TO BE PRINTED";N1$
240 PRINT"ENTER -1- FOR A BOOK OR ARTICLE FORMAT ON 8-1/2x11 COMPUTER PAPER
250 PRINT"      -2- FOR A FORM LETTER ON 8-1/2x11 COMPUTER PAPER
260 PRINT"      -3- FOR A FORM LETTER ON A LETTERHEAD(HAND FEED EACH SHEET)
270 INPUT A
280 IF A<1 OR A>3 THEN PRINT"ILLEGAL CHOICE":GOTO 240
290 INPUT"DOUBLE SPACED LINES";DS$
300 DS$=LEFT$(DS$,1)
310 INPUT"PRINT FILE LINE NUMBERS FOR EDITING";ED$
320 ED$=LEFT$(ED$,1)
330 INPUT"DO YOU WANT TO RIGHT JUSTIFY";RJ$
340 RJ$=LEFT$(RJ$,1)
350 IF A=2 OR A=3 THEN 390
360 IF A=1 THEN 420
370 PRINT"ILLEGAL CHOICE. TRY AGAIN.":GOTO 240
380 '
390 INPUT"ENTER FILE NAME OF NAME & ADDRESS LIST";CL$
400 INPUT"ENTER DATE TO BE PLACED ON LETTER";DT$:GOTO 470
410 '
420 H$="Charles J. Jacobus"
430 F$="Box 645"
440 G$="Mesquite, Texas 75149"
450 INPUT"ENTER NUMBER OF WORDS IN ARTICLE AS XXXXX";W
460 '
470 OPEN"I",1,N1$,1:IF A=1 THEN 550 'TEXT FILE
480 IF CL$="" THEN INPUT"HOW MANY LETTERS DO YOU WANT";NU
490 IF CL$="" THEN 550 'DON'T WANT NAME AND ADDRESS LIST
500 INPUT"IS LIST OF NAMES ON DR#0";Y$
510 IF LEFT$(Y$,1)="Y" THEN 540
520 PRINT"CHANGE DISK ON DR#0. THEN ENTER 'CONT'":STOP
530 UNLOAD 0:MOUNT 0  'REMOUNT DR#0
540 OPEN"I",2,CL$,0 'LIST FILE
550 GOSUB 590 'PRINT TOP OF FIRST PAGE
560 GOTO 980 'GET FIRST LINE OF DATA
570 '
580 FOR K=LCT TO 65:LPRINT:NEXT  'SPACE TO BOTTOM OF SHEET
590 IF A<>1 AND CL$<>"" THEN GOSUB 1970 'GET A NAME & ADDRESS
600 IF A=3 THEN PRINT"FEED LETTERHEAD-THEN ENTER -CONT-":STOP:GOTO 830
610 IF A=2 THEN 830  'LETTER ON COMPUTER PAPER
620 '
630 '****** PRINT TOP OF SHEET ******
640 '
650 FOR I=1 TO 3  '1ST PAGE HEADER FOR ARTICLE
660 LPRINT:NEXT
670 IF P>=2 THEN 730
680 LPRINT TAB(10)H$
690 LPRINT TAB(10)F$
700 LPRINT TAB(10)G$;TAB(50)"Approx. Words:"USING"##,###";W
```

```
1    "CUSTOMER LIST,HEXADEC EQUIP CO,'CUSTLIST',5/8/79
1010 "AIRTHERM MFG CO,BOX 7039,ST LOUIS,MO63177
1392 "BULK PETROLEUM CORP,BOX 427,PARK RIDGE,IL60068
2155 "CUSTOM MFG CO,1104 UNIT 'F' RIDGE RD,LOMBARD,IL60148
3033 "EAGLE MACHINE CO INC,COLLEGE & MARKET STS,INDIANAPOLIS,IN46202
3348 "FERMONT DIV-DYNAMICS CORP,141 NORTH AVE,BRIDGEPORT,CT06606
4006 "HIMELBLAU BYFIELD AND CO,1617 N 31ST ST,MELROSE PARK,IL60160
5005 "W A KRAFT CORP,308 N HARVARD ST,BOSTON,MA02134
5905 "MAGNATROL VALVE CORP,67 FIFTH AVE,HAWTHORNE,NJ07507
7103 "PERFEX CORP,500 W OKLAHOMA AVE,MILWAUKEE,WI53207
7603 "GENERAL INDICATOR-REDCO DIV,BOX M 91,YORK,PA17405
7642 "RUSSELL CO INC,115 MESSINA DR,BRAINTREE,MA02185
8088 "SERVICE ENGINE CO,5825 W OGDEN AVE,CICERO,IL60650
9401 "H S WAYSON COMPANY,1316 67TH ST,EMERYVILLE,CA94608
9998 "NAME(28),ADDRESS(25),CITY(15),ST/ZIP
```

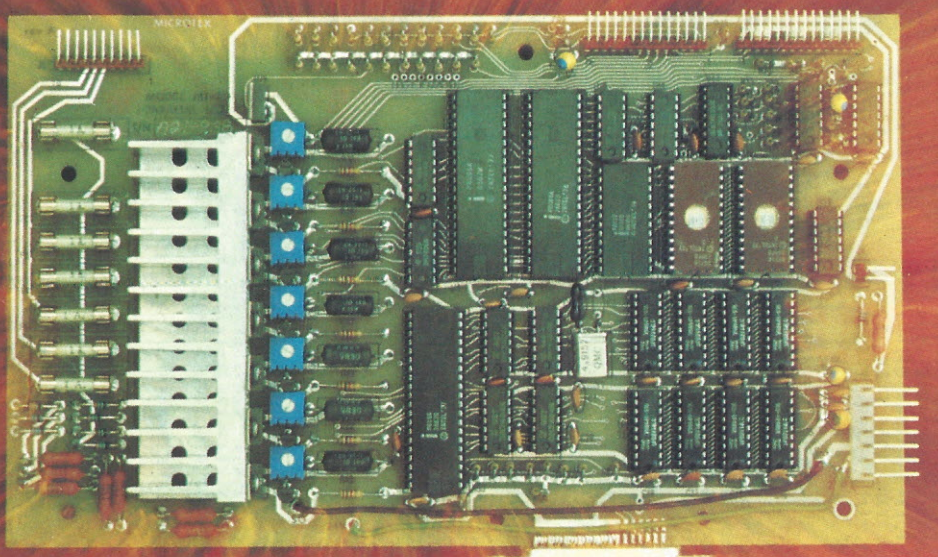
Figure 4. Customer List typed as a program and saved in ASCII.

```
10 WIDTH80'PROGRAM "FIXASCII"  5-15-79  By Charles j. jacobus
20 'INSTRUCTIONS: 1. RUN SEARCH OPTION TO INPUT FILE AND READ IT ON THE SCREEN
                     USING CONTROL S' TO STOP LISTING AS NECESSARY TO STUDY IT.
30 '              2. CHANGE LINE 100 TO MAKE WHATEVER STRING CHANGE IS NEEDED
                     TO CORRECT THE SYNTAX ERROR.
40 '              3. CHANGE THE FILE NAMES IN THE 'OPEN' STATEMENTS TO SUIT
50 '              4. RUN THE FIX OPTION TO CORRECT & RECOPY THE FILE.
60 '              5. CHANGE NEW FILE NAME TO OLD FILE NAME AFTER FIX.
70 '*************************************************************************
80 PRINT"ENTER -1- TO SEARCH ASCII FILE FOR SYNTAX ERROR"
90 INPUT"      -2- TO FIX AND RECOPY INTO NEW ASCII FILE";C
100 IF C<1 OR C>2 THEN PRINT"ILLEGAL CHOICE":GOTO 80
110 IF C=1 THEN 140
120 INPUT"NAME OF NEW FILE AFTER FIX";F2$
130 OPEN"O",2,F2$,1
140 INPUT"NAME OF FILE TO BE SEARCHED OR COPIED";F1$
150 OPEN"I",1,F1$,1
160 IF EOF(1) THEN CLOSE:PRINT"EOJ":END
170 LINEINPUT#1,CH$
180 PRINTCH$
190 IF C=1 THEN 160
200 IF LEFT$(CH$,3)="120" THEN CH$=MID$(CH$,5,LEN(CH$)-4)
210 PRINTCH$
220 PRINT#2,CH$
230 GOTO160
```

Figure 5.

CPU	MITS 8080b with 56K RAM
Disk Drives	Two MITS 8" Floppy
CRT	Soroc IQ-120
Printer	Qume Q-70

Figure 6. List of the author's equipment.



IT'S THE THOUGHT THAT COUNTS

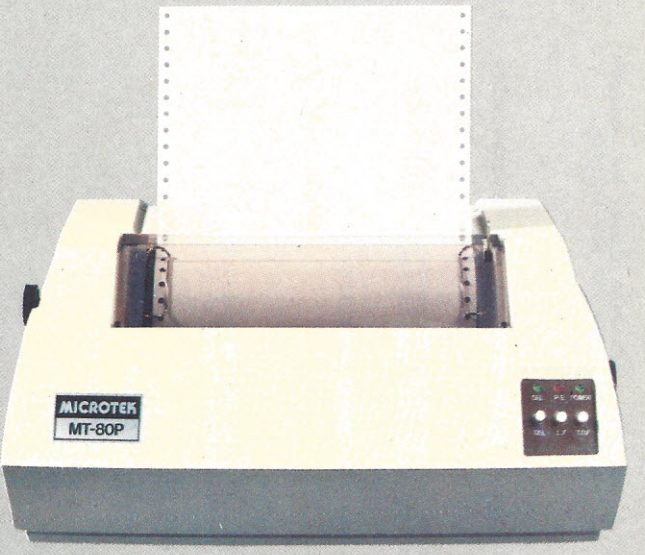
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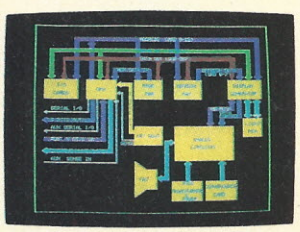
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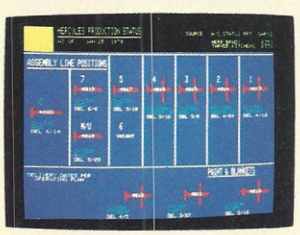
```
710 FOR I=1 TO 12:LPRINT:NEXT
720 LCT=18:P=2:RETURN
730 LPRINT TAB(10)H$;TAB(62)"Page";P  '2ND PAGE HEADER FOR ARTICLE
740 IF FSW=1 THEN FSW=0 ELSE 790 'SPACE DOWN FOR NEW CHAPTER
750 FOR I=1 TO 12
760 LPRINT
770 NEXT
780 LCT=16:GOTO 810
790 LPRINT:LPRINT:LPRINT:LPRINT 'SPACE DOWN FOR CONTINUATION SHEET
800 LCT=8
810 P=P+1:RETURN
820 '
830 IF P>=2 THEN 930 '2ND OR AFTER PAGES OF LETTER
840 FOR I=1 TO 12:LPRINT:NEXT '1ST PAGE FOR LETTER
850 LPRINT TAB(58)DT$
860 LPRINT:LPRINT:LPRINT
870 IF CL$="" THEN LPRINT:LPRINT:LPRINT:GOTO 910
880 LPRINT SPC(10)NS$
890 LPRINT SPC(10)AD$
900 LPRINT SPC(10)CY$;", ";ST$
910 LPRINT:LPRINT:LPRINT
920 LCT=22:P=2:GOTO 980
930 LPRINT:LPRINT:LPRINT  '2ND PAGE HEADER FOR LETTER
940 LPRINT SPC(10)DT$;"  ";NS$;TAB(60)"Page";P
950 P=P+1
960 LPRINT:LPRINT:LCT=6:RETURN
970 '
980 '****** GET A LINE OF DATA & PROCESS IT ******
990 '
1000 IF A$<>"" THEN 1120  'A$ NOT EMPTY YET
1005 IF EOF(1) AND ERSW=1 THEN 1180
1010 IF EOF(1) AND A=1 THEN 1850
1020 IF EOF(1) AND A>1 THEN 1890
1030 LINE INPUT#1, A$
1040 IF LEFT$(A$,1)="" THEN 1010
1050 V=INSTR(A$," ")
1060 N$=LEFT$(A$,V):N%=VAL(N$)
1070 IF N%<11 THEN 1010 'DELETE REMARKS OR ANY LOW TEST LINES
1080 A$=MID$(A$,V+2,LEN(A$)-V+1) 'DELETES LINE NUMBER
1090 IF LEFT$(A$,3)="   " THEN 1010 'SKIP EMPTY LINE
1100 IF RIGHT$(A$,1)=" " THEN A$=LEFT$(A$,LEN(A$)-1):GOTO 1100'CLEAN RIGHT NULLS
1110 IF JSW=1 THEN JSW=0:GOTO 1160 'A$ FULL, B$ FULL
1120 IF B$="" THEN B$=A$:A$="":JSW=1:GOTO 1010 'FILL EMPTY B$. GET NEW A$
1130 IF RIGHT$(B$,1)="&" OR RIGHT$(B$,1)="[" THEN 1160 ELSE 1140
1140 IF RIGHT$(B$,1)="]" OR RIGHT$(B$,1)="*" THEN 1160
1150 IF LEN(B$)<62 THEN B$=B$+" "+A$:A$="":GOTO 1010 'FILL B$, NEW A$
1160 IF LEFT$(B$,1)=" " THEN B$=MID$(B$,2,LEN(B$)-1):GOTO 1160
1170 '
1180 IF BSW=1 THEN C$=LEFT$(B$,49):GOTO 1260
1190 IF CSW=1 THEN C$=LEFT$(B$,31):GOTO 1260
1200 IF LEFT$(B$,1)="%" THEN C$=MID$(B$,2,49):BSW=1:ASW=0:DSW=0:GOTO 1270
1210 IF LEFT$(B$,1)="#" THEN C$=MID$(B$,2,31):CSW=1:ASW=0:DSW=0:GOTO 1270
1220 IF LEFT$(B$,1)="^" THEN C$=MID$(B$,2,56):KSW=1:ASW=0:DSW=0:GOTO 1270
1230 IF LEFT$(B$,1)=">" THEN C$=MID$(B$,2,61):ASW=0:DSW=0:GOTO 1270
1240 IF LEFT$(B$,1)="\"THEN GSW=1:ASW=0:DSW=0:B$=MID$(B$,2,LEN(B$)-1):GOTO 1610
1250 C$=LEFT$(B$,62)
1260 L1=LEN(C$):GOTO 1280
1270 L1=LEN(C$)+1
1280 IF L1>LEN(B$) THEN B$="":GOTO 1310
1290 B$=MID$(B$,L1+1,LEN(B$)-L1)
1300 '
1310 IF RIGHT$(C$,1)="&" THEN ASW=1:HSW=1
1320 IF RIGHT$(C$,1)="*" THEN DSW=1:HSW=1
1330 IF RIGHT$(C$,1)="]" THEN ESW=1:HSW=1
1340 IF RIGHT$(C$,1)="[" THEN FSW=1:HSW=1
1350 IF HSW=1 THEN 1370
1360 B$=RIGHT$(C$,1)+B$
1370 C$=LEFT$(C$,LEN(C$)-1)
1380 IF HSW=1 THEN HSW=0:GOTO 1610 'DONT RIGHT JUSTIFY
1390 '
1400 '****** CLIP OFF PARTIAL WORD & PUT IT BACK IN B$ ******
1410 '
1420 IF RIGHT$(C$,1)=" " THEN 1610 'SPACE THERE. DONT RIGHT JUSTIFY
1430 IF RIGHT$(C$,1)<>" " THEN D$=RIGHT$(C$,1):B$=D$+B$:D$=""
          :C$=LEFT$(C$,LEN(C$)-1):GOTO 1430
1440 '
1450 '****** RIGHT JUSTIFY WHEN CALLED ******
1460 '
1470 IF RJ$<>"Y" THEN 1610
1480 IF BSW=1 THEN X=48:GOTO 1520 ')
1490 IF CSW=1 THEN X=30:GOTO 1520 ')SHORTER LINE WHEN INDENTED
1500 IF KSW=1 THEN X=55:GOTO 1520 ')
1510 X=60 'LENGTH OF FULL LINE
1520 E$=C$
1530 IF RIGHT$(E$,1)=" " THEN E$=LEFT$(E$,LEN(E$)-1):GOTO 1530
1540 J=LEN(E$):JS=J:IF J=X THEN 1590
1550 IF MID$(E$,J,1)=" " THEN 1570
1560 J=J-1:IF J>1 THEN 1550 ELSE 1590
1570 E$=LEFT$(E$,J)+" "+RIGHT$(E$,JS-J):JS=JS+1
1580 IF LEN(E$)<X THEN 1560
1590 C$=E$
1600 '
1610 '****** PRINT A LINE ******
1620 '
1630 IF GSW=1 AND ED$="Y" THEN LPRINT TAB(75)N%:GSW=0:GOTO 1810
1640 IF GSW=1 THEN LPRINT:GSW=0:GOTO 1810
1650 IF BSW=1 AND ED$="Y" THEN LPRINT TAB(18)C$;TAB(75)N%:GOTO 1730
1660 IF BSW=1 THEN LPRINT SPC(18) C$:GOTO 1730
1670 IF CSW=1 AND ED$="Y" THEN LPRINT TAB(40)C$;TAB(75)N%:GOTO 1730
1680 IF CSW=1 THEN LPRINT SPC(40) C$:GOTO 1730
1690 IF KSW=1 AND ED$="Y" THEN LPRINT TAB(15)C$;TAB(75)N%:KSW=0:GOTO 1730
1700 IF KSW=1 THEN LPRINT SPC(15) C$:KSW=0:GOTO 1730
1710 IF ED$="Y" THEN LPRINT TAB(10)C$;TAB(75)N%:GOTO 1730
1720 LPRINT SPC(10)C$
1730 IF ESW=1 AND A=1 THEN 1910 'END ROUTINE FOR ARTICLE
1740 IF ESW=1 AND (CNT+1)>=NU THEN 1950 'END LETTERS THAT HAVE NO ADDRESS LIST
1750 IF ESW=1 THEN ESW=0:CNT=CNT+1:P=1:LCT=LCT+1:GOSUB 580:
     GOTO 980 'START ANOTHER LETTER
1760 IF FSW=1 THEN CSW=0:BSW=0:LCT=LCT+1:GOSUB 580:GOTO 980
     'END CHAPTER-TURN PAGE
1770 IF DSW=1 THEN DSW=0:BSW=0:CSW=0:GOTO 1810 'END PARAGRAPH-NO SPACE DOWN
1780 IF DS$="Y" THEN LPRINT:LCT=LCT+1
1790 IF ASW=1 AND DS$<>"Y" THEN LPRINT:LCT=LCT+1
1800 IF ASW=1 THEN ASW=0:BSW=0:CSW=0 'END PARAGRAPH-SPACE DOWN
1810 C$=""
1820 LCT=LCT+1:IF LCT>=59 THEN GOSUB 580 'PAGE TURN
1830 GOTO 980  'NEXT LINE OF TEXT
1840 '
1850 '****** NEXT FILE/CHAPTER ROUTINE ******
1860 '
1870 N=VAL(MID$(N1$,2,4)) 'PROVIDES FOR LETTER & 4 DIGIT FILE NO.
1880 N=N+1:N$=STR$(N):N1$=LEFT$(N1$,1)+MID$(N$,2,LEN(N$)-1)
1890 CLOSE 1:OPEN"I",1,N1$,1:GOTO 980
1900 '
1910 '****** END ROUTINE ******
1920 '
1930 LPRINT:LPRINT:LPRINT
1940 LPRINT TAB(33)"*** END ***"
1950 CLOSE:PRINT"EOJ":END
1960 '
1970 '****** GET NAME AND ADDRESS FOR LETTER ******
1980 '
1990 IF CL$="" THEN RETURN
2000 IF EOF(2) THEN 1950 'END OF LIST ENDS PROGRAM
2010 LINE INPUT#2,CH$
2020 NH$=LEFT$(CH$,4):NH=VAL(NH$):IF NH<100 THEN 2000
2030 E=INSTR(CH$,",")
2040 NS$=MID$(CH$,7,E-7)
2050 F=INSTR(E+1,CH$,",")
2060 AD$=MID$(CH$,E+1,F-E-1)
2070 G=INSTR(F+1,CH$,",")
2080 CY$=MID$(CH$,F+1,G-F-1)
2090 ST$=MID$(CH$,G+1,7)
2100 RETURN
2110 '
2120 IF ERL=1890 THEN ERSW=1:GOTO 980
```

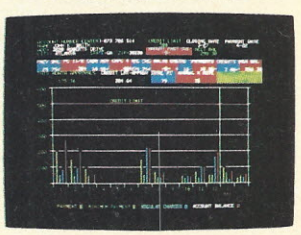


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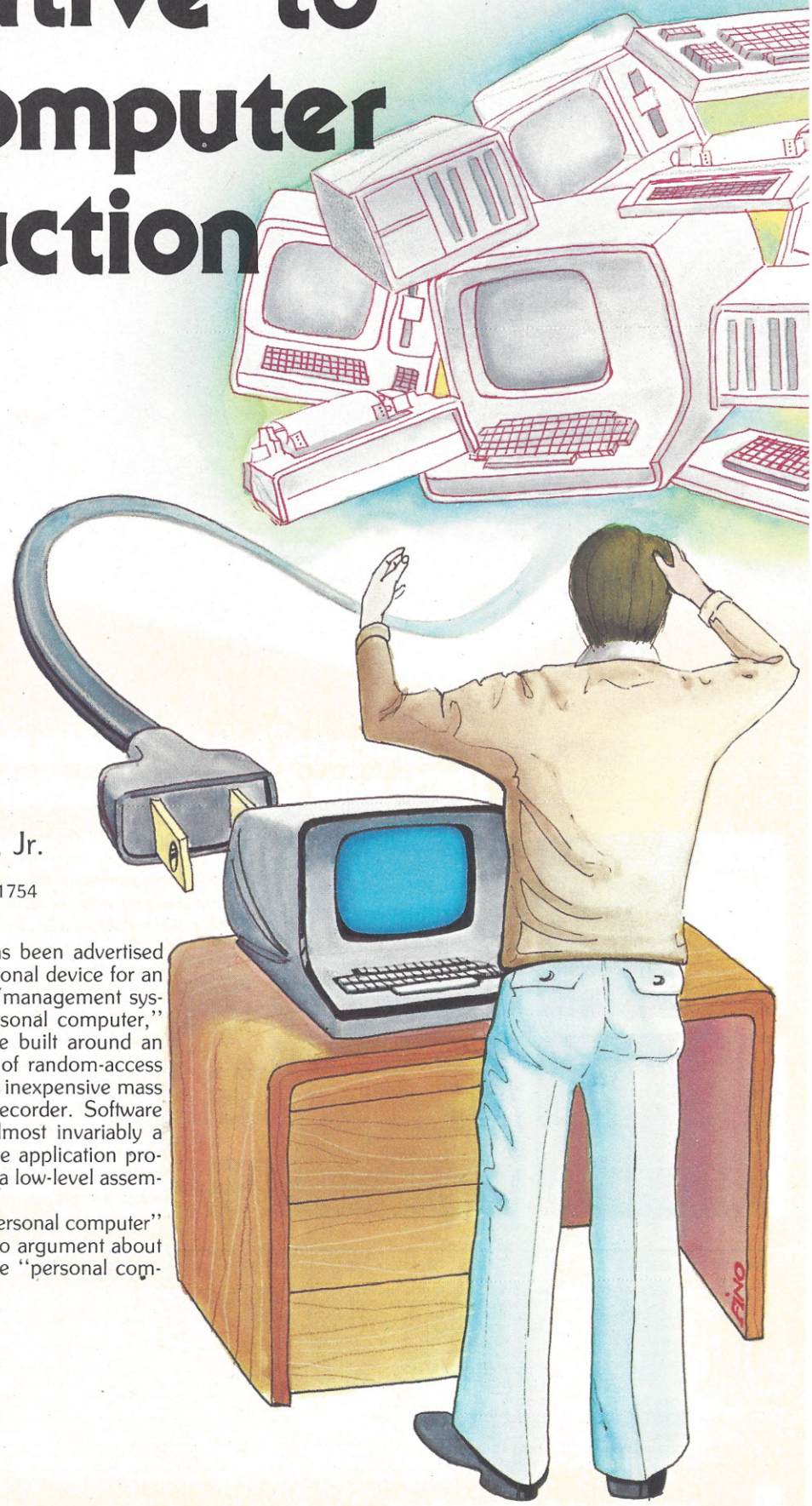
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Alternative to Microcomputer Construction



By Stephen A. Kallis, Jr.
Digital Equipment Corporation
129 Parker Street, Maynard, MA 01754

The so-called "personal computer" has been advertised two ways: as a recreational and computational device for an individual, and as a low-cost accounting/management system for the small businessman. By "personal computer," the advertiser generally refers to a device built around an 8-bit microprocessor, with 4-8 kilobytes of random-access semiconductor memory, and some sort of inexpensive mass storage device, usually a cassette tape recorder. Software may consist of a high-level language (almost invariably a form of BASIC), and include a few simple application programs (alternatively, the system may have a low-level assembler and utility programs).

Much has been written on the joys of "personal computer" ownership for the hobbyist, and there is no argument about its use for such purposes. But what of the "personal computer" as a business tool?

Illustration by Fino Ortiz

The businessman who buys such a system soon discovers that the low-cost "minimum system" personal computer is not the panacea he or she thought. For operations beyond those that could be performed with almost equal facility on a programmable calculator, the user must have additional system components. These usually include additional memory, some sort of hard-copy output device, a higher-capacity and more rapid sort of mass storage device (such as a floppy disk), and a significant amount of additional application software.

At this point, the user has to face some hard choices. Either the "personal computer" has to be expanded or it should be abandoned as a business system. If expanded by the user, the following become that user's responsibility: system configuration, software development, application software support, and system documentation. Hardware and system software support normally are the province of a system manufacturer, but can be restricted by the availability of service facilities and workload. For example, a manufacturer or store oriented towards consumer electronics may have a considerably slower service cycle than a business dependent upon a computer system could tolerate.

Thus, the user who starts out with a $600 entry-level personal computer system may end up spending ten times that amount (or roughly $6,000) to implement it as an effective business system. And the resulting system can be a configuration unique to the user, requiring a significant, ongoing degree of system support and documentation.

Usually, somewhere along the line, the user becomes discouraged and begins to wonder whether trying to computerize was really such a good idea.

Actually, for a small business to acquire and use a computer system is neither difficult nor costly, if it is approached in a proper fashion. What the business owner or manager has to realize is that "having a computer" does not in itself make running a business any more easy; what is important is to understand what features of a computer system are desirable to suit the particular needs of that person's business, and then determine whether there are systems that can satisfy those needs or can easily be modified to do so.

Price aside, there are three basic ways to computerize a business: a computer system can be built "from scratch," something that the business purchasing a personal computer system often ends up doing; a system can be purchased as a "turnkey" assembly, where every aspect of programming, documentation, and training is assumed by the seller (whether the computer manufacturer or a third party); or a computer system can be bought that is a generalized solution to a problem — say, for business functions — and be "fine tuned" by the particular user. In this last case, the majority of the system's features can be supported — serviced and enhanced — by the seller rather than being the responsibility of the user.

Traditional manufacturers of computer systems have in the past few years introduced systems either directly intended for business applications or reasonably easy to adapt to such operations. In the case of some manufacturers, recent low-cost entries start becoming competitive with maximum-configuration personal computer systems, when the software development, support, and documentation costs are factored in. This is due in part to the development of microcomputer systems that are compatible with existing minicomputer lines.

The advantage of compatibility between systems is that most or all of the software developed on earlier and more expensive minicomputer systems can run on the lower-cost systems incorporating microcomputer technology. In many cases, high-level languages such as an extended version of BASIC, or FORTRAN, are available. Utilizing these languages, small systems can be used on a "stand-alone" basis, or may in some cases be tied to other computer systems, if required. It is even possible to transfer application programs between systems by removable storage media such as floppy disks or cassettes.

Some companies offer turnkey systems, which are ready for use as soon as they are plugged in. While somewhat more expensive than the expanded version of the personal computer, these systems have built-in benefits for the small businessman. First, they come complete with company-supported software that has been field-proven over several years. This, in any computer system, is particularly useful since it permits potential users to talk with others who have already used the software to see whether they have been satisfied with its performance.

Second, complete documentation, both software and hardware, is either supplied or easily available. Coupled with the above, among the major manufacturers at least, geographically dispersed service facilities permit system repair with minimum downtime.

In some cases, small business computer systems may be "run-time" systems. A run-time system is one in which application programs developed on another system are employed, but in which application programs cannot be developed. A run-time system is particularly useful in businesses where the user wishes to keep program development separate from daily activities.

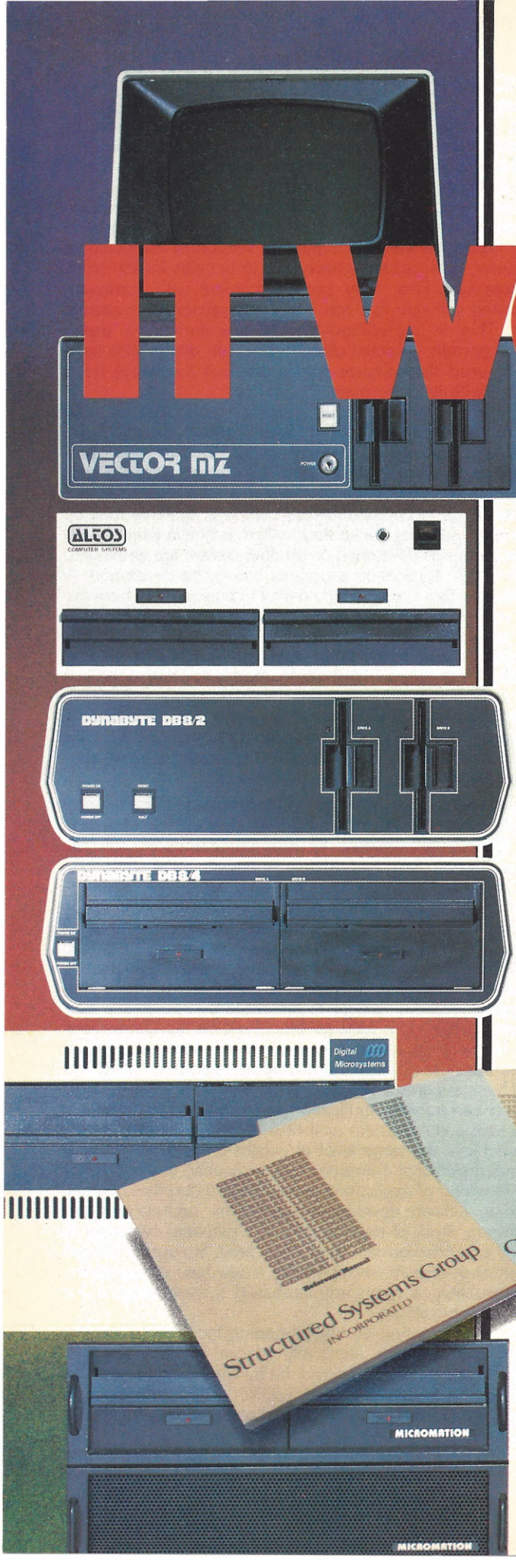
In other cases, particularly where the user has to develop specific "fine tuned" application programs, and does not have access to another system, the "development system" in the form of the small business computer may be preferred. As the name implies, the development system permits the user to create new application programs on the same system that is used for daily business activities.

Small ready-made business systems provide the user with both flexibility and an ability for one or another type of expansion. With the full capability of using minicomputer software, the small system can frequently take advantage of other software packages available from the manufacturer. For example, there is an optional package for word processing available for DEC's Datasystem 308 that permits the system to be used as more than a standard business computer, if desired. In this sense "expansion" refers to increased capabilities available with standard software packages.

Expansion can also refer to increased computer use as a business grows. The software employed on the Datasystem 150, for instance, is upward compatible to some of Digital's largest business-oriented minicomputer systems. Thus, if a small business grows beyond the capacity of its small system, the user can transfer application programs and records to a larger compatible system with little, if any, difficulty.

To achieve the same level of expansion from an already-expanded personal computer system usually requires complete rewriting of application programs and data files, usually including software development problems, such as program debugging. And, of course, since the personal computer is already expanded or near its practical limit, the user is obliged to start from scratch, shopping for a new type of computer, most probably a minicomputer-based system suitable for business applications.

It is worth pointing out that shopping for a minicomputer system from scratch effectively places the businessman "back on square one." Should the businessman need to expand beyond the capabilities of a personal computer system, the system knowledge that has been obtained may be of little use when trying to choose a new system.



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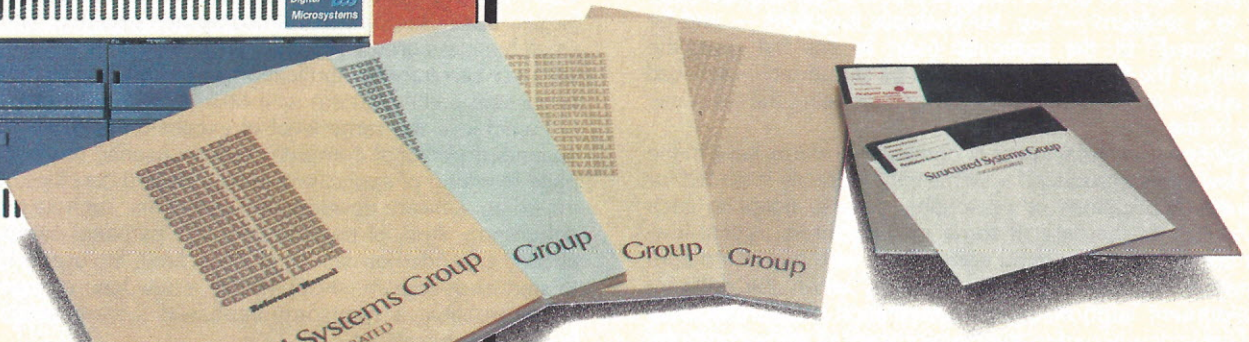
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CIRCLE INQUIRY NO. 76

Expansion from a personal computer to a different minicomputer system has particular pitfalls when there is no software compatibility. Interestingly, some high-level languages are not standardized, and even a minicomputer system that runs BASIC may run a version that is somewhat different from that used on the small system.

While not a "fatal" situation, it may require the user to check over programs with special care when transitioning from the small system to the larger. And if the user wishes to keep the first system as an auxiliary or partial back-up, two sets of unique software documentation may have to be kept; documentation, further, that must be rigidly segregated so that nobody tries to modify or trouble-shoot one system with the other's software listings in hand.

Even the support provided by the manufacturer of the minicomputer or the third party selling the system will have to be explored carefully by the potential user. Since any major minicomputer manufacturer is usually geared to provide faster service than is likely to be encountered with the typical personal computer, the user without any previous experience may have to weigh the various classes of service (e.g., site visit, depot repair, preventive maintenance contract versus one-time call).

By starting with a small system designed by a standard minicomputer manufacturer for business applications, the user not only can enjoy the full level of support provided by that manufacturer, but also can get some idea about what level of support might be required for any larger systems that might be contemplated. In addition, of course, the documentation and programs, being compatible, would make support by the manufacturer easier, if the user does expand the computational facilities.

Another feature common to major computer manufacturers is the existence of "users societies." Many companies encourage and support activities involving users of their equipment; the typical users society acts as a combined library and clearing house, allowing users with associated interests to donate and exchange application programs. Within some societies, such as DECUS (Digital Equipment Computer Users Society), special interest groups have been formed so that people having virtually identical problems and program concerns can exchange data, programs and experiences. Some programs in libraries kept by these groups might be of immediate value to a small business system user, and are usually available at a low cost.

In addition to accepting and disseminating members' application programs, an active users society generally holds one or more symposia per year where users can get together to discuss problems and solutions, as well as programming short cuts. Also, users societies generally publish newsletters, magazines, symposium proceedings, or combinations of these types of publications that provide further insights to hardware and software.

SPECIFICS

As a result of the many standard, yet in some respects "invisible to the outsider," services that are supplied by major manufacturers, the "bargain" aspects of the personal computer for business users may turn out to be quite illusory. When program development, system maintenance and associated support are added to the hardware costs, the bargain price disappears.

By contrast, the small system designed by a manufacturer specifically for business functions may have a somewhat higher price, yet may prove to be the real bargain system in the end. For the manufacturer stands behind it as a system, offering full hardware and system support, much more rapid repair time if needed, and all the side benefits that are associated with a company that has had years of experience building and servicing computer systems developed expressly for the businessman and his or her needs.□

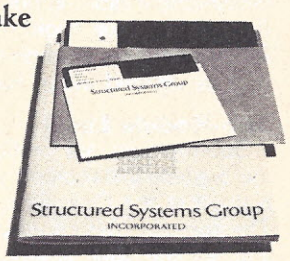
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CIRCLE INQUIRY NO. 77

TIME ANALYSIS & BILLING SYSTEM

By Will Hagenbuch

The Time Accounting and Billing System (TABS) is a project planning and estimating tool for use by software system developers as well as for those professions whose normal efforts can be categorized into a predefined series of efforts or events. TABS includes the facility for updating time estimates for these predefined efforts, the conversion of the updated time estimates into tangible elapsed costs, the accommodation of miscellaneous direct costs associated with the project, keeping track of project progress, preparation of client statements based on completed efforts and miscellaneous direct costs, and the recording of client payments.

TABS requires a 32K TRS-80 Model I disk-based microcomputer and a line printer. A single-disk system may be used; however, it would be more prudent to use a dual-disk system if multiple client files are required. The TABS system is distributed to accommodate the dual-disk operation; however, it may be easily modified if a single-disk operation is preferred.

TERMINOLOGY

TABS performs the time estimating and updating functions at three levels — application, module and sub-module. In addition, TABS will accommodate project-associated direct costs which are to be billed to the client.

Application Level

Up to twenty different applications may be maintained for each client. The application is the highest level in the hierarchical estimating order. Normally, an application would cover a rather broad area of systems development. An example of an application might be "General Accounting" or "Inventory Control."

Module Level

The module is a sub-element of an application. In other words, applications are made up of one or more modules. A module can best be described as a manageable segment of the development effort. In our example of the application "General Accounting," we might use "General Ledger" or "Accounts Receivable" as examples of modules. Up to 16 modules may be defined within each of the 20 possible applications.

Sub-Module Level

Sub-modules are predefined to the TABS system during the System Initialization phase which will be more fully explained in the Operation Description section of this article. The sub-modules constitute the lowest level of the hierarchy and are the level at which actual estimating is performed. TABS is initialized with functional titles for the sub-modules you wish to use. The author suggests sub-module titles which reflect the accepted phases of software systems development for the majority of business oriented projects:

1. Systems Analysis
2. Systems Design
3. Programming
4. Testing
5. Documentation
6. Installation

However, you may redefine these terms (up to nine) to fit your particular environment.

Project costs are computed by indicating the percentage of completion of estimated effort at the sub-module level. These costs are then consolidated at the module and application levels to arrive at total development costs based upon completed efforts.

Non-Standard Costs

In addition to the "standard" development costs described above, you may have other direct costs associated with the project that are to be billed to the client. TABS will accommodate these other "non-standard" costs when creating client billing.

PROJECT PLANNING
(Processing Menu Options 1, 2 and 3)

Certain project planning is required prior to using TABS. This planning includes charting the scope of the project into applications areas and modules within these applications. Once this has been done (and it doesn't have to be perfect the first time, as we shall see later), you are ready to use TABS.

When you first fire up the system (following System Initialization, which will be discussed later), you will be prompted to enter the identification of a client. After doing so, you will be provided the Main Processing Menu from which you may add applications (Menu Option 2) and modules (Menu Option 3) that you envision using.

In case you later want to change the Client Identification information you may do so with Main Processing Menu Option 1; or, if you wish to change applications or module you may do so with Menu Options 2 or 3, respectively.

PROJECT ESTIMATING
(Processing Menu Option 4)

If you were to ask 100 computer professionals how to estimate systems development time and costs, you would get at least 101 different answers. TABS certainly will not be perfect in all cases, but its computations are based on certain industry standards as well as observations and experience of its author. However, feel free to adapt it to your own application.

TABS accommodates estimating at the sub-module (or lowest) level. Probably most of the 100 CPs will agree with this theory. This is done by using Menu Option 4 and indicating the application and module to be estimated.

Original estimates may be made in either of two ways: total or partial. When the "total" estimating option is selected, the number of hours you provide is considered to be the total hours required to complete the entire module. This total number of hours is pro-rated to each of the sub-modules in accordance with the following percentages of distribution which are used by the author:

Systems Analysis	20%
Systems Design	15%
Programming	20%
Testing	25%
Documentation	10%
System Installation	10%

Again, you may prefer some other set of percentages for your functional definitions. In any case, the total percentages for all functions should add up to 100%.

If the "partial" estimating option is selected, the hours you provide will be lodged against one specific sub-module (also selected by you) and then will be computed for the other sub-modules in accordance with the above distribution percentages.

After sub-module estimates are made by one of the above methods, TABS will display your estimates and enable you to alter any with which you disagree. For example, these distribution percentages are based upon the assumption that you are writing the software from "scratch." If you plan to install off-the-shelf software, the estimates may be altered accordingly.

After you have completed the estimating task for all modules (or all that you can at this time), you may use Menu Option 8 to print a "Workload Report" which will list each of the applications and modules with their associated estimated hours. If you don't like something, you can use Menu Options 1 through 4 to modify anything in the files.

UPDATING ELAPSED TIME AND COSTS (Menu Option 5)

TABS computes project costs (which are to be subsequently billed to the client) by multiplying completed hours times your individual rate per hour. Each of the sub-modules can have a different rate, if you should desire. The completed hours are determined by providing TABS with your percentage of completion for each of the sub-modules in the system. This option enables you to provide this information to TABS.

After updating a module (by updating the required sub-modules within the module), TABS will redisplay the updated information so that you can check its validity. Should you later determine that you have a program "glitch" and are not as complete as previously stipulated, TABS will compensate the billing when you reduce your percentage of completion.

Updating sub-modules with the percentage of completion will also correspondingly reduce (or increase) the remaining hours on future "Workload Reports."

After updating necessary sub-modules, TABS will accept any non-standard costs which are to be accrued to the client's account. Non-standard costs are retained with a description, date, and the amount and are then reflected on the next client statement.

CLIENT BILLING (Menu Option 6)

This option will create a printed statement of the client's account including "to-date" charges (standard and non-standard, if any) and "to-date" payments made by the client. The statement may be prepared at any time during the life cycle of the project and, at your option, may be used for either information purposes or actual billing.

The statement reflects both the total estimated charges and the actual charges to date for each module on the client's file. The account summary at the bottom of the statement contains the "Balance Forward" (previously billed but not yet paid), the current billing for services (standard costs), current billing for direct expenses (non-standard costs), and the current Balance Due.

RECEIPT OF PAYMENT (Menu Option 7)

This option will enable you to record payments received from the client and apply them to the client's account for consideration in subsequent statement preparation.

PRINT WORKLOAD REPORT (Menu Option 8)

This option enables you to print, upon demand, a report of the total workload remaining for the client. The report reflects the total estimated hours, by module, and the remaining hours for that module based upon the percentage of completion you have indicated in Menu Option 5 (Updating Elapsed Time and Costs).

OPERATION DESCRIPTION

System Initialization

The first time you execute the TABS program (called "START") your processing will be automatically directed to the "INIT" program. This is the program which initializes such system constants as your name and address for the heading on client statements and the definition of sub-modules you wish to use along with the hourly rate you charge for that functional effort and the distribution of effort (expressed as a percentage of the total) for that function.

Figure 1 shows the first screen that will be displayed when the program "INIT" is executed:

The first line of this screen reflects the number of clients currently accommodated by the system. This is followed by the functional titles (sub-modules), hourly rate for that function, and assigned workload distribution percentages.

The functional titles and percentages shown in Figure 1 are those used by the author and are provided for reference only. You may select functional titles and percentages of your own choosing. You will, however, be required to select your own hourly rates since these are entirely an individual preference.

Use the prompt at the bottom of the screen to enter the line number of the function (or sub-module) to be updated. Each of the data elements on the line will then be prompted for modification.

Please note that an additional code may be used in response to this prompt. If you enter the character "C," your index of clients will be reinitialized (that's just a big word for "killed"). This facility has been added because you may wish to run some test cases before beginning actual operation. When you have tested TABS' capabilities and are ready to begin actual processing, run the "INIT" program and use the "C" entry to clean up all test files. *Caution:* any data on file is lost when you use this option.

Figure 2 is the second and final screen of the Initialization Program. You may use this screen to enter your name and address as you would have it appear on client statements created by the system. Since your name and address will appear in the center of the statement format, you may wish to center the entries for better presentation.

You may wish to prepare client statements on your personal letterhead. If so, do not enter your name and address; just depress the <ENTER> key to terminate initialization. If only the <ENTER> key is used in response to prompts issued by Screen 1 or Screen 2, no action will be taken. This is true of any screen prompts in the TABS system.

System Operation

Figure 3 presents the Main Processing Menu for the TABS system. All actions, except the System Initialization described above, emanate from this menu of system options. It is recommended that exit from system operation always be made from this Main Processing Menu (by depressing the <ENTER> key in response to the "Select Action" prompt) to insure file integrity.

(1) Client Maintenance

Using this option, the information in any Client Account file may be modified. You will find that new client accounts may be added to your system either at normal start-up time or whenever you use Option (9) to change to a different client. Therefore, the addition of new clients is not a function of the Client Maintenance option.

This option enables modification of the Client Name and Address or direct adjustment of the to-date amounts either billed or paid. Normally, these latter two data elements are not updated by this option, since they are automatically updated as a function of options (6) and (7).

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NOTE → Z80 version requires 20K RAM. 8080 version requires 24K RAM. (Memory requirements are additional to CP/M and application program.)

When ordering HDBS or MDBS please specify if the version required is for 1) Microsoft L80 i.e. FORTRAN-80, COBOL-80, BASIC COMPILER, 2) MBASIC 4. XX, or 3) BASIC-80 5.0.

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☐ **PASCAL/Z** — Z80 native code PASCAL compiler. Pro- Ⓘ duces optimized, ROMable re-entrant code. All interfacing to CP/M is through the support library. The package includes compiler, companion macro-assembler and source for the library. Requires 56K and Z80 CPU.
Version 2 includes all of Jensen/Wirth except variant records $275/$25
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☐ **ACCOUNTS PAYABLE** — Provides aged statements †† of accounts by vendor with check writing for selected invoices. Can be used alone or with General Ledger and/or with NAD. Requires CBASIC-2 $1250/$25

☐ **PAYROLL** — Flexible payroll system handles weekly, †† bi-weekly, semi-monthly and monthly payroll periods. Tips, bonuses, re-imbursements, advances, sick pay, vacation pay, and compensation time are all part of the payroll records. Prints government required periodic reports and will post to multiple SSG General Ledger accounts. Requires CBASIC-2 and 54K of memory $1250/$25

☐ **INVENTORY CONTROL SYSTEM** — Performs control †† functions of adding and depleting stock items, adding new items and deleting old items. Tracks quantity of items on hand, on order and back-ordered. Optional hard copy audit trail is available. Reports include Master Item List, Stock Activity, Stock Valuation and Re-order List. Requires CBASIC-2 $1250/$25

☐ **ANALYST** — Customized data entry and reporting sys- †† tem. User specifies up to 75 data items per record. Interactive data entry, retrieval, and update facility makes information management easy. Sophisticated report generator provides customized reports using selected records with multiple level break-points for summarization. Requires CBASIC-2 $250/$15

☐ **LETTERIGHT** — Program to create, edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailings. Requires CBASIC-2 ..$200/$25

☐ **NAD** Name and Address selection system — interac- tive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2 $100/$20

☐ **QSORT** — Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created $100/$20

Now-applications software for Microsoft's BASIC interpreter!

PEACHTREE SOFTWARE

☐ **GENERAL LEDGER** — Records details of all financial Ⓛ transactions. Generates a balance sheet and an in- †† come statement. Flexible and adaptable design for both small businesses and firms performing client writeup services. Produces reports as follows: Trial Balance, Transaction Registers, Balance Sheet, Prior Year Comparative Balance Sheet, Income Statement, Prior Year Comparative Income Statement and Department Income Statements. Interactive with other PEACHTREE accounting packages. Supplied in source code for Microsoft BASIC $990/$30

New Features

☐ **ACCOUNTS PAYABLE** — Tracks current and aged Ⓛ payables and incorporates a check writing feature. †† Maintains a complete vendor file with information on purchase orders and discount terms as well as active account status. Produces reports as follows: Open Voucher Report, Accounts Payable Ageing Report and Cash Requirements. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC $990/$30

☐ **ACCOUNTS RECEIVABLE** — Generates invoice regis- Ⓛ ter and complete monthly statements. Tracks current †† and aged receivables. Maintains customer file including credit information and account status. The current status of any customer account is instantly available. Produces reports as follows: Aged Accounts Receivable, Invoice Register, Payment and Adjustment Register and Customer Account Status Report. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC .. $990/$30

☐ **PAYROLL** — Prepares payroll for hourly, salaried and Ⓛ commissioned employees. Generates monthly, quar- †† terly and annual returns. Prepares employee W-2's. Includes tables for federal withholding and FICA as well as withholding for all 50 states plus up to 20 cities from pre-computed or user generated tables. Will print checks. Payroll Register, Monthly Summary and Unemployment Tax Report. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC $990/$30

☐ **INVENTORY** — Maintains detailed information on Ⓛ each inventory item including part number, descrip- †† tion, unit of measure, vendor and reorder data, item activity and complete information on current item costs, pricing and sales. Produces reports as follows: Physical Inventory Worksheet, Inventory Price List, Departmental Summary Report, Inventory Status Report, The Reorder Report and the Period-to-Date and Year-to-Date reports. Supplied in source code for Microsoft BASIC $1,190/$30

☐ **MAILING ADDRESS** — Keeps track of name and ad- Ⓛ dress information and allows the selective printing of †† this information in the form of mailing lists or address labels. Allows the user to tailor the system to his own particular requirements. User-defined format and print-out system uses a special format file which tells programs how to print the mailing list or address labels. Standard format files are included with system. Automatic sorting of data uses indexed file management routines which allow the name and address information to be sequentially retrieved and printed without file sorting. Supplied in source code for Microsoft BASIC $790/$30

GRAHAM-DORIAN SOFTWARE SYSTEMS

☐ **GENERAL LEDGER** — An on-line system; no batch- Ⓛ ing is required. Entries to other GRAHAM-DORIAN Ⓜ accounting packages are automatically posted. User †† establishes customized C.O.A. Provides transaction register, record of journal entries, trial balances and monthly closings. Keeps 14 month history and provides comparison of current year with previous year. Requires CBASIC-2. Supplied in source ... $995/$35

New Features

☐ **ACCOUNTS PAYABLE** — Maintains vendor list and Ⓛ check register. Performs cash flow analysis. Flexible Ⓜ — writes checks to specific vendor for certain in- †† voices or can make partial payments. Automatically posts to GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source $995/$35

☐ **ACCOUNTS RECEIVABLE** — Creates trial balance re- Ⓛ ports, prepares statements, ages accounts and rec- Ⓜ ords invoices. Provides complete information describ- †† ing customer payment activity. Receipts can be posted to different ledger accounts. Entries automatically update GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source $995/$35

☐ **PAYROLL SYSTEM** — Maintains employee master file. Ⓛ Computes payroll withholding for FICA, Federal and Ⓜ State taxes. Prints payroll register, checks, quarterly †† reports and W-2 forms. Can generate ad hoc reports and employee form letters with mail labels. Requires CBASIC-2. Supplied in source $590/$35

☐ **INVENTORY SYSTEM** — Captures stock levels, costs, Ⓛ sources, sales, ages, turnover, markup, etc. Trans- Ⓜ action information may be entered for reporting by †† salesman, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC-2. Supplied in source ... $590/$35

☐ **JOB COSTING** — Designed for general contractors. Ⓛ To be used interactively with other GRAHAM-DORIAN Ⓜ accounting packages for tracking and analysing ex- †† penses. User establishes customized cost categories and job phases. Permits comparison of actual versus estimated costs. Automatically updates GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source $995/$35

☐ **APARTMENT MANAGEMENT SYSTEM** — Financial Ⓛ management system for receipts and security de- Ⓜ posits of apartment projects. Captures data on va- †† cancies, revenues, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. Requires CBASIC-2. Supplied in source $590/$35

☐ **CASH REGISTER** — Maintains files on daily sales. Ⓛ Files data by sales person and item. Tracks sales, Ⓜ over-rings, refunds, payouts and total net deposits. †† Requires CBASIC-2. Supplied in source ... $590/$35

☐ **tiny C** — Interactive interpretive system for teaching Ⓧ structured programming techniques. Manual includes full source listings $105/$40

☐ **BDS C COMPILER** — Supports most major features of Ⓜ language including Structures, Arrays, Pointers, re- Ⓘ cursive function evaluation, linking loader and library. Floating point function library included. Lacks data initialization and static and register class specifiers. Documentation includes "THE C PROGRAMMING LANGUAGE" by Kernighan and Ritchie. $125/$15

☐ **WHITESMITHS C COMPILER** — The ultimate in sys- Ⓛ tems software tools. Produces faster code than Pas- Ⓜ cal with more extensive facilities. Conforms to the Ⓧ full UNIX* Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M $630/$30

☐ **POLYVUE/80** — Full screen editor for any CRT with Ⓜ XY cursor positioning. Includes vertical and horizontal scrolling, interactive search and replace, automatic text wrap around for word processing, operations for manipulating blocks of text, and comprehensive .70 page manual $135/$15

☐ **POLYTEXT/80** — Text formatter for word processing Ⓜ applications. Justifies and paginates source text files. Will generate form letters with custom fields and conditional processing. Support for Daisy Wheel printers includes variable pitch justification and motion optimization $85/$15

☐ **ALGOL-60** — Powerful block-structured language compiler featuring economical run time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling direct disk address I/O etc. Requires Z80 CPU $199/$20

☐ **Z80 DEVELOPMENT PACKAGE** — Consists of: (1) disk Ⓜ file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file $95/$20

☐ **ZDT** — Z80 Monitor Debugger to break and examine Ⓜ registers with standard Zilog/Mostek mnemonic disassembly displays. $35 when ordered with Z80 Development Package $50/$10

☐ **DISTEL** — Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files, Intel or TDL/Xitan pseudo ops optional. Runs on 8080 $65/$10

☐ **DISILOG** — As DISTEL to Zilog/Mostek mnemonic Ⓜ files. Runs on Z80 only $65/$10

☐ **XASM-68** — Non-macro cross-assembler with nested conditionals and full range of pseudo operations. As sembles from standard Motorola MC6800 mnemonics to Intel hex $200/$25

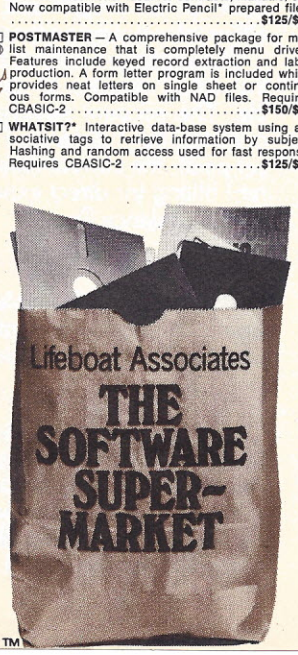
☐ **XASM-65** — As XASM-68 for MOS Technology MCS- 6500 series mnemonics $200/$25

☐ **TEXTWRITER III** — Text formatter to justify and pag- Ⓜ inate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertions. Ideal for contracts, manuals, etc. Now compatible with Electric Pencil* prepared files. $125/$20

☐ **POSTMASTER** — A comprehensive package for mail Ⓜ list maintenance that is completely menu driven. Features include keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Compatible with NAD files. Requires CBASIC-2 $150/$15

New Features

☐ **WHATSIT?*** Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC-2 $125/$25



Shopping List No.11

Software for most popular 8080/Z80 computer disk systems including ***NORTH STAR, iCOM, MICROPOLIS, DYNABYTE DB8/2 & DB8/4, EXIDY SORCERER, SD SYSTEMS, ALTAIR, VECTOR MZ, MECA, 8" IBM, HEATH H17 & H89, HELIOS, IMSAI VDP42 & 44, REX, NYLAC, INTERTEC, VISTA V80 and V200, TRS-80 MODEL I and MODEL II, ALTOS, OHIO SCIENTIFIC***

Everything on Shopping List #11 runs on 64K TRS-80 Model II

Software with Manual / Manual Alone

☐ **XYBASIC** Interactive Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in Integer, Extended and ROMable versions. Integer Disk or Integer ROMable$295/$25 Extended Disk or Extended ROMable$395/$25

☐ **SMAL/80** Structured Macro Assembled Language — Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs$75/$15

☐ **SELECTOR III-C2** — Data Base Processor to create Ⓜ and maintain multi Key data bases. Prints formatted †† sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source ...$295/$20

Lower Price!

☐ **GLECTOR** — General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types insure proper double entry bookkeeping. Generates balance sheets, P&L statements and journals. Two year record allows for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2, CBASIC-2 and 52K system$250/$25

☐ **CPM/374X** — Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files$195/$10

☐ **BASIC UTILITY DISK** — Consists of: (1) CRUNCH-14 Ⓜ — Compacting utility to reduce the size and increase the speed of programs in Microsoft BASIC and TRS-80 BASIC. (2) DPFUN — Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on diskette and documentation ...$50/$35

☐ **STRING/80** — Character string handling plus routines Ⓜ for direct CP/M BDOS calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programs to chain to a COM file, retrieve command line parameters, and search file directories with full wild card facilities. Supplied as linkable modules in Microsoft format.$95/$20
STRING/80 source code available separately $295/n.a.

☐ **THE STRING BIT** — FORTRAN character string han- Ⓜ dling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source$45/$15

☐ **BSTAM** — Utility to link one computer to another also Ⓜ equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansion to send ★.COM, etc. 9600 baud with wire. 300 baud with phone connection. **Both** ends need one. Standard and Ⓜ versions can talk to one another.$150/$5

★★★★★★★

SUNDRIES & NOTIONS

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☐ **FLIPPY DISK KIT** — Template and instructions to modify single sided 5¼″ diskettes for use of second side in single sided drives$12.50

☐ **FLOPPY SAVER** Protection for center holes of 5¼″ floppy disks. Only 1 needed per diskette. Kit contains centering post, pressure tool, tough 7-mil mylar reinforcing rings. Installation tools and rings for 25 diskettes$14.95
Re-orders of rings only$7.95

☐ **PASCAL USER MANUAL AND REPORT** — By Jensen and Wirth. The standard textbook on the language. Recommended for use by Pascal/Z, Pascal/M and Pascal/MT users$8

☐ **THE C PROGRAMMING LANGUAGE** — By Kernighan and Ritchie. The standard textbook on the language. Recommended for use by BDS C, tiny C, and Whitesmiths C users$12

★★★★★★★

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Z80 is a trademark of Zilog, Inc.
UNIX is a trademark of Bell Laboratories.
WHATSIT? is a trademark of Computer Headware.
Electric Pencil is a trademark of Michael Shrayer Software.
TRS-80 is a trademark of Tandy Corp.
Pascal/M is a trademark of Sorcim.

†CP/M for Heath and TRS-80 Model I are modified and must use specially compiled versions of system and applications software.

††Recommended system configuration consists of 48K CP/M, 2 full size disk drives, 24 x 80 CRT and 132 column printer.

ⓂModified version available for use with CP/M as implemented on Heath and TRS-80 Model I computers.

ⓁUser license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

①ⓍThis product Includes/eXcludes the language manual recommended in Sundries and Notions.

VISA master charge

Orders must specify disk systems and formats: e.g. North Star single, double or quad density, IBM single or 2D/256, Altair, Helios II, Micropolis Mod I or II, 5¼″ soft sector (Micro iCOM/SD Systems Dynabyte), etc.

Prices F.O.B. New York. Shipping, handling and C.O.D. charges extra.

Manual cost applicable against price of subsequent software purchase.

The sale of each proprietary software package conveys a license for use on one system only.



™

```
NUMBER OF CLIENTS ON FILE: n

.............................................

  FUNCTION TITLES     HOURLY RATE      PERCENT

=============================================

(1) SYSTEM ANALYSIS      $$.00          .20

(2) SYSTEM DESIGN        $$.00          .15

(3) PROGRAMMING          $$.00          .20

(4) TESTING              $$.00          .25

(5) DOCUMENTATION        $$.00          .10

(6) INSTALLATION         $$.00          .10

(7)                        .00          .00

(8)                        .00          .00

(9)                        .00          .00

.............................................

WHICH FUNCTION IS TO BE CHANGED? .
```

Figure 1.

```
YOUR NAME AND ADDRESS FOR

STATEMENT PREPARATION

.............................

(1)

(2)

(3)

.............................

WHICH LINE IS TO BE CHANGED? .
```

Figure 2.

```
CLIENT TIME ANALYSIS & BILLING

MAIN PROCESSING MENU

.................................

   (1) Client Maintenance

   (2) Application Maintenance

   (3) Module Maintenance

   (4) Prepare or Revise Estimate

   (5) Update Elapsed Time & Costs

   (6) Client Billing

   (7) Receipt of Payment

   (8) Print Workload Report

   (9) Change to Different Client

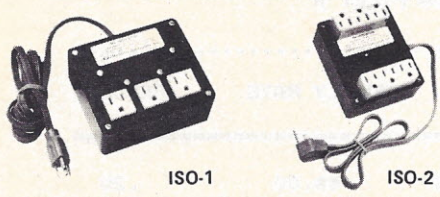
   Any Other Code to Terminate

.................................

SELECT OPTION: .
```

Figure 3.

DISK DRIVE WOES? PRINTER INTERACTION?
MEMORY LOSS? ERRATIC OPERATION?
DON'T BLAME THE SOFTWARE!



ISO-1 ISO-2

Power Line Spikes, Surges & Hash could be the culprit!
Floppies, printers, memory & processor often interact!
Our unique ISOLATORS eliminate equipment interaction
AND curb damaging Power Line Spikes, Surges and Hash.

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*SUPER ISOLATOR (ISO-3), similar to ISO-1A except double filtering & Suppression $79.95

*ISOLATOR (ISO-4), similar to ISO-1A except unit has 6 individually filtered sockets $93.95

*ISOLATOR (ISO-5), similar to ISO-2 except unit has 3 socket banks, 9 sockets total . . . $76.95

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(2) Application Maintenance

This option enables you to add or delete applications for a client or modify the title of extant applications. Up to twenty different applications may be used for each client and whenever the prompt "WHICH APPLICATION?" is displayed you may respond with "?" to display the list of current applications for the client being processed.

(3) Module Maintenance

This option enables you to add or delete modules for a client application or to modify the title of the module. Up to sixteen different modules may be defined for each client application. The modules that have been defined for a client application will be displayed each time this option is used so that you may select the module with which you wish to work.

(4) Prepare or Revise Estimates

Estimates are prepared at the module level. This option enables the preparation of such estimates based upon the sub-module functions you have defined during System Initialization. Original estimates may also be revised using this option.

(5) Updated Elapsed Time & Costs

This option enables you to update your original (or revised) estimates at the sub-module level by providing a percentage of completion for a specified sub-module. Obviously, upon original estimate, the sub-module is set to zero (0) percentage of completion. Subsequent use of this option enables you to provide new percentages of completion which will be used to update both the workload requirements and client charges for completed work based upon the hourly rates for the sub-module which you supplied during System Initialization.

Non-standard direct costs which are to be billed to the client are also entered using this option.

(6) Client Billing

This option enables the creation of client statements based upon completed effort (standard costs) and other direct expenses (non-standard costs).

Client statements may be prepared for either information or billing purposes. Both types of statements are exactly the same in format and content; however, at your option, any information statement may become a billing statement by electing the option of posting the balance to the client account.

It is recommended that an information statement be prepared after initial estimates are made to become a part of the client contract for services. After work has been performed and the client files have been updated using option (5), client statements (billing) will track throughout the life-cycle of the project.

(7) Receipt of Payments

This option enables the recording and posting of receipts of payments made by the client and will be used in the computation of subsequent client statements.

(8) Print Workload Reports

At any time during the life-cycle of the project, this option will provide a report of the remaining workload requirements based upon original (or revised) estimates and reported completion.

(9) Change to Different Client

You will find that when you fire-up your TABS system (after System Initialization), you will be prompted to select the specific client for which file maintenance is required. (Unless, however, there is only one client on your files in which case TABS needn't ask.)

At any time you wish to work with another client's records or wish to add a new client, use this option to identify the new client.□

Program follows on Page 90

MicroQuote

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MicroNET, the personal computer service of CompuServe, now offers MicroQuote, a comprehensive securities information system.

With MicroQuote you can gain information from a data bank of over 32,000 stocks, bonds and options from the New York, American, OTC and major regional markets plus Chicago options. MicroQuote contains price and volume data from January, 1974 with cumulative adjustment factors and dividend information from January, 1968.

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It's just part of the MicroNET service

MicroNET also allows error-free downloading of software via the new software exchange and executive programs (now available for the TRS-80,® Apple II® and CP/M® systems). It also provides electronic mail service and can be accessed with a 300 baud modem via local phone calls in more than 175 U.S. cities. Write for full details on how your microcomputer can control one of the nation's largest and most sophisticated time-sharing computer centers for about 8 cents a minute!

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Regional distributors and local dealers wanted.
Inquire to Dept. R

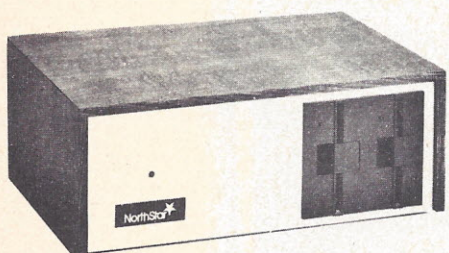
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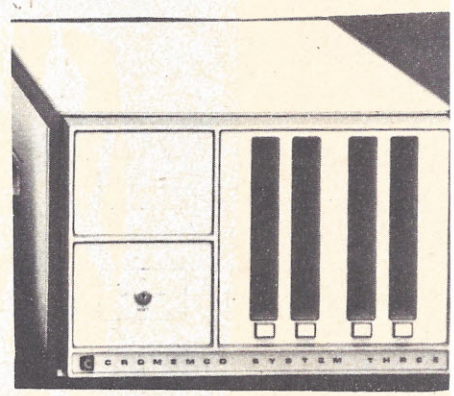
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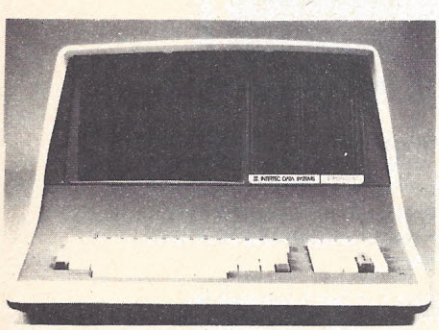
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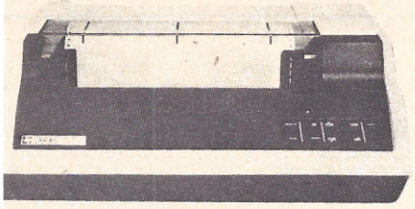
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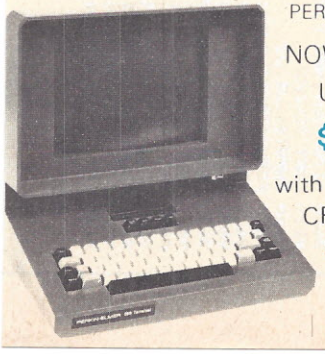
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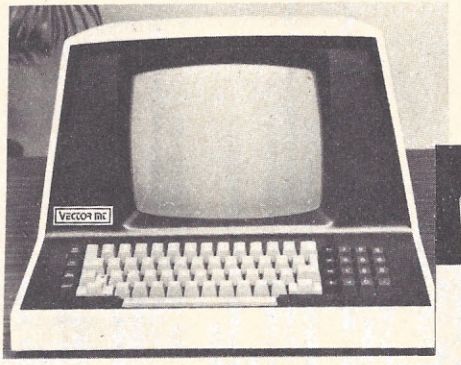
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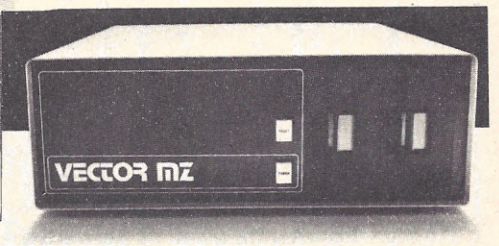
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CIRCLE INQUIRY NO. 110

PROGRAM LISTING
Time Accounting & Billing System (Initialization)

```
10 'INITIALIZE OR MODIFY CONTROL FILE (INIT)
20 CLEAR 1000
30 DEFSNG A-H: DEFINT I-Z
40 ONERRORGOTO190
50 OPEN"I",1,"CTRL":ONERRORGOTO0
60 GOSUB9610:CLOSE
65 OPEN"O",1,"CTRL"
70 CLS:PRINT"NUMBER OF CLIENTS ON FILE:";J1
80 PRINTSTRING$(63,CHR$(138))
90 PRINT"   FUNCTION TITLES";TAB(25)"HOURLY RATE";TAB(40)"PERCENT"
100 PRINTSTRING$(63,"=")
110 FORI=1TO9:PRINTI;SM$(I);TAB(28);
120 PRINTUSING"###.##";AR(I);
122 PRINTTAB(43);
124 PRINTUSING".##";P(I)/100
130 NEXT:PRINTSTRING$(63,CHR$(138))
140 LINEINPUT"WHICH FUNCTION IS TO BE CHANGED? ";X$:X=VAL(X$)
145 IFX=0ANDX$="C"THENJ1=0:GOTO200
150 IFX<1ORX>9GOTO200
160 LINEINPUT"TITLE: ";SM$(X)
170 LINEINPUT"RATE/HOUR: ";X$:AR(X)=VAL(X$)
175 LINEINPUT"PERCENT: ";X$:A=VAL(X$):IFA<1THENA=A*100
177 P(X)=INT(A)
180 GOTO70
190 RESUME195
195 ONERRORGOTO0:GOTO65
200 J2=0:FORI=1TO9:IFSM$(I)<>""THENJ2=J2+1
210 NEXT:CLS
220 PRINT"YOUR NAME AND ADDRESS FOR STATEMENT PREPARATION."
230 PRINTSTRING$(63,CHR$(138))
240 FORI=1TO3:PRINTI;A$(I):NEXT
250 PRINTSTRING$(63,CHR$(138))
260 LINEINPUT"WHICH LINE IS TO BE CHANGED? ";X$:X=VAL(X$)
270 IFX<1ORX>3THENGOSUB9630:CLOSE:RUN"START"
280 PRINT"NEW LINE";X;:LINEINPUT">";A$(X):CLS:GOTO220
9600 'I/O ROUTINES FOR CONTROL FILE (D/S/F/U)
9610 'GET RECORD
9620 INPUT#1,J1,J2
9621 FORU=1TO9:INPUT#1,SM$(U):NEXT
9622 FORU=1TO9:INPUT#1,AR(U):NEXT
9623 FORU=1TO9:INPUT#1,P(U):NEXT
9625 FORU=1TO3:LINEINPUT#1,A$(U):NEXT:RETURN
9630 'PUT RECORD
9640 PRINT#1,J1;J2
9641 FORU=1TO9:PRINT#1,SM$(U):NEXT
9642 FORU=1TO9:PRINT#1,AR(U):NEXT
9643 FORU=1TO9:PRINT#1,P(U):NEXT
9645 FORU=1TO3:PRINT#1,A$(U):NEXT:RETURN
```

```
770 'FIND APPLICATION
780 LINEINPUT"WHICH APPLICATION? ";X$:IFVAL(X$)>0GOTO800
790 GOSUB740:PRINT@960,;:GOTO780
800 V=VAL(X$):IFA$(V)=""THEN790ELSERETURN
810 'FIND MODULE
820 X=0:PRINT@128,;
830 X=X+1:GOSUB9220:PRINTX;"- ";M$
840 M$(X)=M$:CE(X)=CE:CC(X)=CC:L3(X)=L3:UR(X)=UR
850 IFL3=0THENRETURNELSEUR=L3:GOTO830
860 'LOCATE MODULE
875 CLS:PRINT"APPLICATIONS FOR THIS CLIENT:"
880 GOSUB740:GOSUB100
890 X=0:INPUT"WHICH APPLICATION";X
895 UR=L1(X):IFUR=0GOTO2180
900 CLS:PRINT"MODULES FOR ";A$(X);":":PRINT
905 GOSUB9220:L=0
910 PRINTL+1;"- ";M$:L=L+1:M$(L)=M$:UR(L)=UR:CE(L)=CE
    :CC(L)=CC:L3(L)=L3
915 IFL3=0THEN925ELSEUR=L3:GOSUB9220:GOTO910
920 IFL=1THENX=1:GOTO930
925 PRINT:X=0:INPUT"WHICH MODULE";X:IFX=0THENRETURN
930 UR=UR(X):GOSUB9220:RETURN
935 'DISPLAY MODULE TRAILERS
940 CLS:PRINT"MODULE: ";M$
945 PRINT"TOTAL ESTIMATED COSTS: ";
950 PRINTUSINGP$;CE
955 PRINT"TOTAL COMPLETED COSTS: ";
960 PRINTUSINGP$;CC:U=0
962 PRINTTAB(17)"EST/HRS";TAB(28)"RATE/HR";TAB(39)"%COMP";
    TAB(55)"TOTAL
965 FORUT=1TOJ2:GOSUB9240:IFKEY=0GOTO995
970 KEY(UT)=KEY:HR(UT)=HR:CR(UT)=CR:PCT(UT)=PCT:U=1
975 PRINTUT;SM$(KEY);TAB(20);HR;TAB(25);
980 PRINTUSINGP$;CR;
985 PRINTTAB(40);STR$(PCT);"%";TAB(50);
990 PRINTUSINGP$;CR*HR
995 NEXT:RETURN
1060 CLS:PRINT"ADD NEW CLIENT.":GOSUB100
1090 FORI=0TO3:X$="":LINEINPUT">";X$:GOSUB500:N$(I)=X$:NEXT
1100 TR=0:CB=0:CP=0:GOTO5100
1130 CLS:PRINTM2$:GOSUB100
1140 FORI=0TO3
1150 PRINTI+1;"- ";N$(I):NEXT
1160 PRINT" 5  AMOUNT BILLED TO DATE:  ";
1170 PRINTUSINGP$;CB
1180 PRINT" 6  AMOUNT PAID TO DATE:    ";
1190 PRINTUSINGP$;CP
1192 PRINT" 7  PREVIOUS SERVICE COSTS: ";
1194 PRINTUSINGP$;CS
1200 GOSUB100:LINEINPUT"SELECT LINE FOR CHANGE: ";X$:X=VAL(X$):PRINT
1210 IFX<1ORX>7GOTO1250
1220 X$="":LINEINPUT"NEW DATA: ";X$:IFX>4GOTO1240
1230 GOSUB500:N$(X-1)=X$:GOTO1130
1240 A=VAL(X$):IFX=5THENCB=AELSEIFX=6THENCP=AELSECS=A:GOTO1130
1250 OPEN"R",5,F5$:UR=ZZ
1252 FORI=0TO3:X$=N$(I):GOSUB500:N$(I)=X$:NEXT
1260 GOSUB9050:CLOSE5
1270 GOTO350
1500 'APPLICATION MAINTENANCE
1510 CLS:PRINT"APPLICATION MAINTENANCE.":GOSUB100
1520 PRINTTAB(5)"1 - ADD APPLICATION
1530 PRINTTAB(5)"2 - MODIFY APPLICATION TITLE
1540 PRINTTAB(5)"3 - DELETE APPLICATION
1550 GOSUB100:PRINTM1$:LINE INPUT X$:X=VAL(X$):PRINT
1560 IFX<1ORX>3THEN1615ELSEIFX=1GOTO1590
1570 GOSUB770
1580 ONXGOTO1590,1660,1680
1590 TA=TA+1:A$="":LINEINPUT"APPLICATION TITLE: ";X$:GOSUB500:A$=X$
```

PROGRAM LISTING
Time Accounting & Billing System (Operation)

```
10 'SOFTWARE DEVELOPMENT TIME ANALYSIS & BILLING (START)
20 CLEAR2000
30 DEFSNG A-H: DEFINT I-Z
40 DIM A$(21),L1(21),L2(21),L5(21)
50 DIM M$(16),CE(16),CC(16),L3(16),UR(16)
60 DIM D$(30),CA(30),XC(30),DT(30),L4(30)
70 'PROGRAM HOUSEKEEPING
80 Q$=":1"
90 GOTO5000
100 PRINTSTRING$(63,CHR$(138)):RETURN
200 FORK=1TO5:PRINTA$(K);L1(K);L2(K);L5(K):NEXT:STOP
210 FORK=1TO5:PRINTM$(K);L3(K);UR(K):NEXT:STOP
220 FORUR=1TO10:GOSUB9220
230 LPRINTUR;M$;L3:NEXT:STOP
300 M1$="SELECT OPTION: "
310 M2$="MODIFY CLIENT INFORMATION."
311 M3$="WORKLOAD REPORT"
312 M4$="MAKE PRINTER READY."
320 P$="##,###.##"
330 B$=STRING$(24," ")
340 IFS1=1GOTO1060
350 CLS:PRINT"CLIENT TIME ANALYSIS & BILLING":GOSUB100
360 PRINTTAB(5)"1 - CLIENT MAINTENANCE
370 PRINTTAB(5)"2 - APPLICATION MAINTENANCE
380 PRINTTAB(5)"3 - MODULE MAINTENANCE
390 PRINTTAB(5)"4 - PREPARE OR REVISE ESTIMATE
400 PRINTTAB(5)"5 - UPDATE ELAPSED TIME & COSTS
410 PRINTTAB(5)"6 - CLIENT BILLING
420 PRINTTAB(5)"7 - RECEIPT OF PAYMENT
430 PRINTTAB(5)"8 - PRINT WORKLOAD REPORT
435 PRINTTAB(5)"9 - CHANGE TO DIFFERENT CLIENT
440 PRINT:PRINTTAB(5)"ANY OTHER CODE TO TERMINATE
450 GOSUB100:PRINTM1$;:LINEINPUTX$:X=VAL(X$)
460 IFX<1ORX>9THENCLOSE:END
470 ONXGOTO1130,1500,2000,2500,3000,3500,4000,4500,5050
480 CLOSE:STOP:GOTO350
500 'CONVERT DELIMITERS
510 U=INSTR(X$,","):IFU=0THEN520ELSEMID$(X$,U)=">":GOTO510
520 U=INSTR(X$,":"):IFU=0RETURNELSEMID$(X$,U)="<":GOTO520
530 'CONVERT PSEUDO DELIMITERS
540 U=INSTR(X$,">"):IFU=0THEN550ELSEMID$(X$,U)=",":GOTO540
550 U=INSTR(X$,"<"):IFU=0RETURNELSEMID$(X$,U)=":":GOTO550
560 'CONVERT DATE (STRING TO COMPUTATIONAL)
570 DT=0:UM=VAL(X$):U=INSTR(X$,"/"):X$=MID$(X$,U+1)
580 UD=VAL(X$):U=INSTR(X$,"/"):X$=MID$(X$,U+1):UY=VAL(X$)
590 IFUY<70ORUY>99THENRETURNELSEIFUM<1ORUM>12THENRETURN
    ELSEIFUD<1ORUD>31THENRETURN
600 DT=(UY*10000)+(UM*100)+UD:RETURN
610 'CONVERT DATE (COMPUTATIONAL TO STRING)
620 UY=INT(DT/10000):DT=DT-(UY*10000):UM=INT(DT/100)
    :DT=DT-(UM*100)
630 X$=STR$(UM)+STR$(DT)+STR$(UY):X$=MID$(X$,2)
640 U=INSTR(X$," "):IFU=0RETURNELSEMID$(X$,U)="/":GOTO640
650 'PROGRAMMED INTERRUPT
660 LINEINPUT"HIT 'ENTER' TO CONTINUE.";X$:RETURN
740 'DISPLAY APPLICATIONS
745 CLS:X$=N$(0):GOSUB530
    :PRINT"APPLICATIONS FOR ";X$:GOSUB100
750 FORI=1TO20STEP2
760 PRINTI;A$(I);TAB(31);I+1;A$(I+1):NEXT:RETURN
1600 L1(TA)=0:L2(TA)=0:A$(TA)=A$
1610 GOTO1500
1615 GOSUB1620:GOTO350
1620 OPEN"O",1,F1$:GOSUB9530
1630 FORI=1TOTA
1640 A$=A$(I):L1=L1(I):L2=L2(I):L5=L5(I):GOSUB9570
1650 NEXT:CLOSE1:RETURN
1660 PRINT:X$="":LINEINPUT"NEW TITLE: ";X$:GOSUB500
1670 A$(V)=X$:GOTO1500
1680 A$(V)="DELETED":L5(V)=0
1690 IFL1(V)=0THEN1710ELSEUR=L1(V):GOSUB9220:M$="":GOSUB9260
1700 IFL3=0THEN1710ELSEUR=L3:GOSUB9220:M$="":GOSUB9260:GOTO1700
1710 IFL2(V)=0THEN1500ELSEUR=L2(V):GOSUB9390:D$="":GOSUB9410
1720 IFL4=0THEN1500ELSEUR=L4:GOSUB9390:D$="":GOSUB9410:GOTO1720
2000 'MODULE MAINTENANCE
2010 CLS:PRINT"MODULE MAINTENANCE.":GOSUB100
2020 PRINTTAB(5)"1 - ADD MODULE
2030 PRINTTAB(5)"2 - MODIFY MODULE TITLE
2040 PRINTTAB(5)"3 - DELETE MODULE
2050 GOSUB100:PRINTM1$;:LINEINPUTX$:X=VAL(X$):GOSUB100
2060 IFX<1ORX>3GOSUB1620:GOTO350
2070 GOSUB770
2080 ONXGOTO2090,2170,2240
2090 IFL1(V)>0THEN2100
2092 IFL6=0THENL6=1
2094 L1(V)=L6:UR=L6:L6=L6+1:GOTO2135
2100 UR=L1(V):GOSUB9220
2110 IFL3=0THENL3=L6:GOSUB9260:GOTO2130
2120 UR=L3:GOSUB9220:GOTO2110
2130 L6=L6+1:UR=L3
2135 GOSUB9220
2140 X$="":LINEINPUT"MODULE TITLE: ";X$:GOSUB500:M$=X$
2150 FORUT=1TOJ2:KEY=UT:HR=0:CR=0:PCT=0:GOSUB9280:NEXT
2160 L3=0:CE=0:CC=0:GOSUB9260:GOTO2000
2170 UR=L1(V):IFUR>0GOTO2190
2180 PRINTTAB(10)"NO MODULES FOR THIS APPLICATION.":PRINT
     :GOSUB650:GOTO2000
2190 CLS:PRINT"MODULE MODIFICATION FOR ";A$(V):GOSUB100:GOSUB810
2200 PRINT:INPUT"WHICH MODULE IS TO BE MODIFIED";X:IFX=0GOTO2000
2210 UR=UR(X):GOSUB9220
2220 GOSUB100:LINEINPUT"NEW MODULE TITLE: ";X$:GOSUB500:M$=X$
2230 GOSUB9260:GOTO2000
2240 UR=L1(V):IFUR=0GOTO2180
2250 CLS:PRINT"DELETE MODULE":GOSUB100:GOSUB810
2260 PRINT:INPUT"WHICH MODULE IS TO BE DELETED";X:IFX=0GOTO2000
2270 UR=UR(X):GOSUB9220:M$="DELETED"
2280 GOSUB9260:GOTO2000
2500 'INITIALIZE OR REVISE ESTIMATE
2510 CLS:PRINT"INITIALIZE OR REVISE ESTIMATE.":GOSUB100
2520 GOSUB860
2530 IFCE(X)=0GOTO2620
2540 CLS:PRINT"MODULE ";M$(X);" HAS PREVIOUSLY BEEN ESTIMATED."
2550 PRINTTAB(5)"YOU HAVE THE FOLLOWING OPTIONS:
2560 PRINTTAB(10)"1 - REESTIMATE THE ENTIRE MODULE
2570 PRINTTAB(10)"2 - REVISE ONE OR MORE SUB-MODULES
2580 PRINTTAB(10)"3 - EXIT WITHOUT MODIFICATION
2590 PRINT:PRINTM1$;:LINEINPUTX$:X=VAL(X$)
2600 IFX<1ORX>3GOTO2590
2610 ONXGOTO2620,2840,350
2620 GOSUB935:IFU=0GOTO2180
2630 PRINT:LINEINPUT"WILL ESTIMATE BE IN TOTAL HOURS (T)
 OR PARTIAL HOURS (P)? ";X$
2640 IFX$="P"GOTO2750
2650 IFX$<>"T"GOTO2630
2660 PRINT:LINEINPUT"WHAT IS TOTAL ESTIMATED HOURS FOR MODULE? ";X$
2670 X=VAL(X$):IFX=0THEN2660ELSECE=0
2680 FORI=1TOJ2:IFKEY(I)=0GOTO2740
```

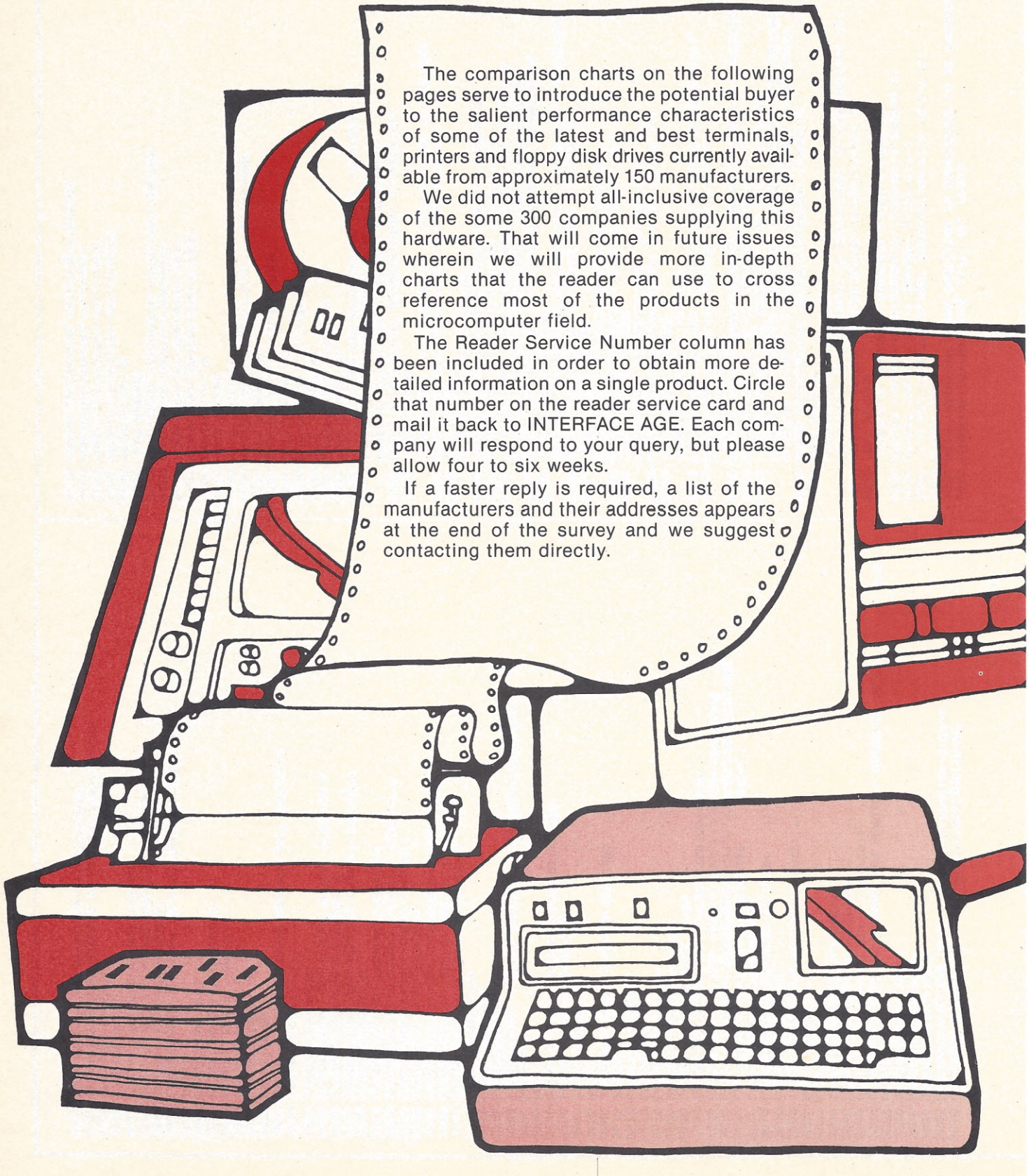
```
2690 IFKEY(I)=1 OR KEY(I)=3 THEN HR(I)=INT(((X*.2)+.5)*100)/100:GOTO2730
2700 IFKEY(I)=2 THEN HR(I)=INT(((X*.15)+.5)*100)/100:GOTO2730
2710 IFKEY(I)=4 THEN HR(I)=INT(((X*.25)+.5)*100)/100:GOTO2730
2720 HR(I)=INT(((X*.1)+.5)*100)/100
2730 CR(I)=AR(KEY(I)):CE=CE+(INT(HR(I))*CR(I))
2740 NEXT:FORUT=1TOJ2:KEY=KEY(UT):HR=HR(UT):CR=CR(UT)
     :PCT=PCT(UT):GOSUB9280:NEXT:GOSUB9260:GOSUB9220
     :GOSUB935:GOTO2850
2750 PRINT:LINEINPUT"WHICH SUB-MODULE LINE IS TO BE USED
 FOR PARTIAL ESTIMATE? ";X$
2760 X=VAL(X$):IFX<1ORX>J2GOTO2750
2770 A=P(X)/100
2810 PRINT:LINEINPUT"HOW MANY HOURS FOR THIS SUB-MODULE? ";X$
2820 B=VAL(X$):IFB=0GOTO2810
2830 A=(1/A)*B:X$=STR$(A):GOTO2670
2840 GOSUB935
2850 PRINT:LINEINPUT"WHICH SUB-MODULE IS TO BE REVISED? ";X$:X=VAL(X$)
2855 IFX=0GOTO2920
2860 X$="":LINEINPUT"NEW ESTIMATED HOURS: ";X$
2870 IFX$=""THEN2880ELSEHR(X)=VAL(X$)
2880 X$="":LINEINPUT"NEW RATE: ";X$
2890 IFX$=""THEN2900ELSECR(X)=VAL(X$)
2900 X$="":LINEINPUT"NEW PCT/COMPL: ";X$
2910 IFX$=""THEN2912ELSEPCT(X)=VAL(X$)
2912 LINEINPUT"IS ANOTHER SUB-MODULE TO BE REVISED? ";X$
2914 IFLEFT$(X$,1)="N"GOTO2920
2916 IFLEFT$(X$,1)<>"Y"GOTO2912
2918 SW=1
2920 CE=0:FORUT=1TOJ2
2930 KEY=KEY(UT):HR=HR(UT):CR=CR(UT):PCT=PCT(UT):CE=CE+HR*CR
2940 GOSUB9280:NEXT
2950 GOSUB9260
2952 IFSW=0GOTO2960
2954 SW=0:GOTO2840
2960 LINEINPUT"IS ANOTHER ESTIMATE REQUIRED? ";X$
2970 IFX$="N"GOTO350
2980 IFX$<>"Y"GOTO2960
2990 GOTO2500
3000 'UPDATE ELAPSED TIME & COSTS
3010 CLS:PRINT"UPDATE ELAPSED TIME.":GOSUB100
3020 GOSUB860:IFX=0THEN3120ELSEGOSUB935:CC=0
3030 PRINT:PRINT"ENTER LINE NUMBER , PERCENT OF COMPLETION (0,0 TO QUIT)
3040 INPUTL,P:IFL=0GOTO3060
3050 PCT(L)=P:GOTO3040
3060 FORUT=1TOJ2
3070 KEY=KEY(UT):HR=HR(UT):CR=CR(UT):PCT=PCT(UT):CC=CC+(PCT*(HR*CR))/100
3080 GOSUB9280:NEXT:GOSUB9260:GOSUB935
3082 PRINT:LINE INPUT"IS THIS MODULE CORRECT? ";X$
3084 IFX$="Y"GOTO3090
3086 IFX$<>"N"THEN3082ELSE3030
3090 PRINT:LINEINPUT"IS ANOTHER MODULE TO BE UPDATED? ";X$
3100 IFX$="Y"GOTO3010
3110 IFX$<>"N"GOTO3090
3120 CLS:LINEINPUT"IS DIRECT COSTS UPDATING REQUIRED? ";X$
3122 IFX$="N"GOTO350
3124 IFX$<>"Y"GOTO3120
3126 CLS:PRINT"UPDATE DIRECT COSTS.":PRINT
3128 IFL7=0THENL7=1
3140 UR=L7:L7=L7+1
3170 LINEINPUT"DESCRIPTION:     ";D$
3180 LINEINPUT"COST:            ";X$:CA=VAL(X$)
3190 LINEINPUT"DATE(MM/DD/YY): ";X$:GOSUB560:IFDT=0GOTO3190
3200 XC=0:L4=0:GOSUB9410
3210 PRINT:LINEINPUT"IS ANOTHER DIRECT COST TO BE ENTERED? ";X$
3220 IFX$="Y"GOTO3126
3230 IFX$<>"N"GOTO3210
3240 GOTO350
3500 'CLIENT BILLING

4030 INPUT"WHAT IS AMOUNT OF PAYMENT";A:IFA=0GOTO350
4040 PRINT:LINEINPUT"IS THIS CORRECT? ";X$
4050 IFLEFT$(X$,1)="N"GOTO4010
4060 IFLEFT$(X$,1)<>"Y"GOTO4040
4070 CP=CP+A:GOTO1250
4500 'WORKLOAD REPORT
4510 CLS:PRINTM3$:PRINT:PRINTM4$:PRINT
4520 LINEINPUT"REPORT DATE: ";DT$:HA=0:HT=0:P1$="####"
4530 LPRINTM3$;" AS OF: ";DT$:LPRINT""
4540 LPRINT"CLIENT:";
4550 FORI=0TO3:LPRINTTAB(10):N$(I):NEXT:LPRINT""
4560 FORI=1TOTA:IFLEFT$(A$(I),7)="DELETED"THEN4670ELSELPRINT""
4570 LPRINT"APPLICATION: ";A$(I):IFL1(I)=0GOTO4670
4580 LPRINT"":UR=L1(I):GOSUB9220
4585 IFLEFT$(M$,7)="DELETED"GOTO4640
4590 LPRINTTAB(6)"MODULE: ";M$
4600 FORUT=1TOJ2:GOSUB9240:IFHR=0GOTO4630
4610 LPRINTTAB(10);SM$(UT);TAB(30);:HZ=(HR*(100-PCT))/100
4620 LPRINTUSINGP1$;HZ:HA=HA+HZ
4630 NEXTUT
4640 IFL3>0THENUR=L3:GOSUB9220:GOTO4585
4650 LPRINT"":LPRINTTAB(10)"TOTAL FOR APPLICATION:";TAB(40);
4660 LPRINTUSINGP1$;HA:HT=HT+HA:HA=0
4670 NEXTI:LPRINT""
4680 LPRINT"TOTAL HOURS REMAINING FOR THIS CLIENT:   ";
4690 LPRINTUSINGP1$;HT:LPRINTCHR$(140):GOTO350
5000 ONERRORGOTO5030
5005 F4$="CTRL"
5010 OPEN"I",4,F4$
5020 ONERRORGOTO0:GOSUB9610:GOTO5050
5030 RESUME5040
5040 RUN"INIT"
5050 CLOSE:CLS:F5$="CLIENT"+Q$
5060 OPEN"R",5,F5$:IFJ1=0GOTO5090
5070 LINEINPUT"DO YOU WANT TO ADD NEW CLIENT? ";X$
5080 IFLEFT$(X$,1)="N"THEN5108ELSEIFLEFT$(X$,1)<>"Y"THEN5070
5090 GOTO1060
5100 J1=J1+1:UR=J1:GOSUB9050:CLOSE
5105 OPEN"O",4,F4$:GOSUB9630:CLOSE:OPEN"R",5,F5$
5108 IFJ1=1THENX=1:GOTO5150
5110 CLS:FORUR=1TOJ1:GOSUB9030:X$=N$(0):GOSUB530
5120 PRINTUR;X$:NEXT:PRINT
5130 LINEINPUT"WHICH CLIENT DO YOU WANT? ";X$:X=VAL(X$)
5140 IFX<=0ORX>J1GOTO5130
5150 UR=X:GOSUB9030:CLS
5160 FORI=0TO3:X$=N$(I):GOSUB530
5170 PRINTX$:NEXT:PRINT:IFJ1=1GOTO5200
5180 LINEINPUT"IS THIS CORRECT CLIENT? ";X$
5190 IFLEFT$(X$,1)="N"THEN5110ELSEIFLEFT$(X$,1)<>"Y"THEN5180
5200 F1$="AP"+STR$(UR)+Q$:MID$(F1$,3)="P"
5210 F2$="SCOS"+STR$(UR)+Q$:MID$(F2$,5)="T"
5220 F3$="NCOS"+STR$(UR)+Q$:MID$(F3$,5)="T"
5230 CLOSE:ONERRORGOTO5250:ZZ=UR
5240 OPEN"I",1,F1$:XA=1:GOTO5270
5250 RESUME5260
5260 ONERRORGOTO0
5270 OPEN"R",2,F2$:OPEN"R",3,F3$
5280 IFXA=0THENTA=0:GOTO5330
5290 GOSUB9510
5300 IFEOF(1)THENGOTO5330
5310 GOSUB9550:TA=TA+1:X$=A$:GOSUB530:A$(TA)=X$
5320 L1(TA)=L1:L2(TA)=L2:L5(TA)=L5:GOTO5300
5330 CLOSE1:ONERRORGOTO0:GOTO300
6000 RESUME6010
6010 PRINT:PRINT"ERROR AT LINE";ERL;"CAUSED ABORT OF PROGRAM. FILES BEING SAVED.
6020 PRINT:PRINT"PLEASE NOTIFY:
6030 PRINTTAB(20)"WILL HAGENBUCH
6040 PRINTTAB(20)"3014 BIGGS COURT
```

```
3510 CLS:PRINT"CLIENT BILLING.":PRINT:PRINTM4$:PRINT
3520 LINEINPUT"BILLING DATE: ";DT$:NT=0:A#=0:B#=0:E#=0
3526 LPRINTTAB(20);Y$(1)
3528 LPRINTTAB(20);Y$(2)
3530 LPRINTTAB(20);Y$(3)
3532 LPRINT""
3534 LPRINT"STATEMENT OF ACCOUNT FOR SERVICES RENDERED AS OF: ";     DT$
3540 LPRINT" ":LPRINT"CLIENT:";TAB(10);
3550 FORK=0TO3:IFN$(K)=""GOTO3580
3560 X$=N$(K):GOSUB530:LPRINTX$
3570 LPRINTTAB(10);
3580 NEXTK:LPRINT" "
3590 LPRINT"CUMULATIVE BILLED TO DATE: ";
3600 LPRINTUSINGP$;CB
3610 LPRINT"CUMULATIVE PAID TO DATE:    ";
3620 LPRINTUSINGP$;CP:C#=CB-CP
3622 LPRINT"":LPRINTTAB(41)"ESTIMATED     ACTUAL"
3630 LPRINT" ":FORJ=1TOTA:IFLEFT$(A$(J),7)="DELETED"GOTO3685
3640 LPRINT"APPLICATION: ";A$(J):UR=L1(J):IFUR=0GOTO3685
3650 GOSUB9220:IFLEFT$(M$,7)="DELETED"GOTO3680
3655 LPRINTTAB(6)"MODULE: ";M$;
3660 A#=A#+CC:LPRINTTAB(41);
3670 LPRINTUSINGP$;CE;
3672 LPRINTTAB(52);
3674 LPRINTUSINGP$;CC
3676 E#=E#+CE
3680 IFL3=0THEN3685ELSEUR=L3:GOTO3650
3685 NEXTJ
3690 IFL7<=1GOTO3742
3700 FORUR=1TOL7-1:GOSUB9390
3720 NT=NT+1:D$(NT)=D$:CA(NT)=CA:DT(NT)=DT
3740 NEXTUR
3742 LPRINT""
3744 LPRINT"TOTAL ACCRUED COSTS FOR SERVICES:";TAB(41);
3746 LPRINTUSINGP$;E#;
3748 LPRINTTAB(52);
3750 LPRINTUSINGP$;A#
3752 LPRINT"":IFNT=0LPRINT"":GOTO3762
3754 LPRINT"CURRENT DIRECT COSTS:":LPRINT""
3756 FORI=1TONT:X$=D$(I):GOSUB530:B#=B#+CA(I)
3758 LPRINTTAB(5);X$;TAB(52);
3760 LPRINTUSINGP$;CA(I):NEXT:LPRINT""
3762 LPRINTTAB(10)"ACCOUNT SUMMARY:":LPRINT""
3764 LPRINT"BALANCE FORWARD";TAB(52);
3766 LPRINTUSINGP$;C#
3770 LPRINT"TOTAL NEW SERVICE COSTS:";TAB(52);
3780 LPRINTUSINGP$;A#-CS:A#=A#-CS
3790 LPRINT"TOTAL NEW DIRECT COSTS: ";TAB(52);
3800 LPRINTUSINGP$;B#
3810 LPRINTTAB(52)"---------"
3822 LPRINT"":LPRINTTAB(10)"BALANCE DUE";TAB(52);
3824 C#=C#+A#+B#
3826 LPRINTUSINGP$;C#
3830 LPRINTCHR$(140)
3840 PRINT"CLIENT: ";N$(0)
3850 PRINT"NEW BILLING AMOUNT: ";
3860 PRINTUSINGP$;C#
3870 PRINT
3880 LINEINPUT"DO YOU WANT TO POST THIS BILLING? ";X$
3890 IFLEFT$(X$,1)="N"GOTO350
3900 IFLEFT$(X$,1)<>"Y"THEN3880ELSECB=CB+C#
3910 FORI=1TOTA:L2(I)=0:NEXT:CS=A#
3920 L7=1:GOTO1250
4000 'PAYMENT RECEIPT
4010 CLS:PRINT"RECORD RECEIPT OF PAYMENT FOR:":PRINT
4020 FORI=0TO3:PRINTTAB(10);N$(I):NEXT:PRINT
```

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6050 PRINTTAB(20)"NATIONAL CITY, CA. 92050
6060 PRINT:PRINT"IF ERROR CONDITION IS CONSIDERED TO BE PROGRAM FAULT.
6070 CLOSE: END
9000 'I/O ROUTINES FOR CLIENT INFORMATION FILE (D/R/F/B)
9010 UP=INT((UR-1)/ 2)+1: US=(UR- 2*(UP-1))-1
9020 FIELD5,(US*108)ASU$,24ASU$(0),24ASU$(1),24ASU$(2)
     ,24ASU$(3),4ASU$(4),4ASU$(5),4ASU$(6):RETURN
9030 'GET RECORD
9040 GOSUB 9010:GET 5,UP:N$(0)=U$( 0):N$(1)=U$( 1)
     :N$(2)=U$( 2):N$(3)=U$( 3):CB=CVS(U$( 4)):CP=CVS(U$( 5))
     :CS=CVS(U$( 6)):RETURN
9050 'PUT RECORD
9060 GOSUB 9010:LSETU$( 0)=N$(0):LSETU$( 1)=N$(1)
     :LSETU$( 2)=N$(2):LSETU$( 3)=N$(3):RSETU$( 4)=MKS$(CB)
     :RSETU$( 5)=MKS$(CP):RSETU$( 6)=MKS$(CS):PUT 5,UP:RETURN
9170 'I/O ROUTINES FOR STANDARD COST FILE (D/R/V/B)
9180 UP=INT((UR-1)/ 2)+1: US=(UR- 2*(UP-1))-1
9190 FIELD2,(US*120)ASU$,20ASU$(0),4ASU$(1),4ASU$(2), 2ASU$(3),
      90ASU1$:RETURN
9200 UP=INT((UR-1)/ 2)+1: US=(UR- 2*(UP-1))-1
9210 FIELD2,(US*120)+30+((UT-1)*10)ASU$,2ASU$(4),2ASU$(5),
     4ASU$(6),2ASU$(7):RETURN
9220 'GET HEADER RECORD
9230 GOSUB 9180:GET 2,UP:M$=U$( 0):CE=CVS(U$( 1))
     :CC=CVS(U$( 2)):L3=CVI(U$( 3)):RETURN
9240 'GET TRAILER RECORD
9250 GOSUB 9200:KEY=CVI(U$( 4)):HR=CVI(U$( 5))
     :CR=CVS(U$( 6)):PCT=CVI(U$( 7)):RETURN
9260 'PUT HEADER RECORD
9270 GOSUB 9180:LSETU$( 0)=M$:RSETU$( 1)=MKS$(CE)
     :RSETU$( 2)=MKS$(CC):RSETU$( 3)=MKI$(L3):PUT 2,UP:RETURN
9280 'PUT TRAILER RECORD
9290 GOSUB 9200:RSETU$( 4)=MKI$(KEY):RSETU$( 5)=MKI$(HR)
     :RSETU$( 6)=MKS$(CR):RSETU$( 7)=MKI$(PCT):RETURN
9360 'I/O ROUTINES FOR NON-STANDARD COST FILE (D/R/F/B)
9370 UP=INT((UR-1)/ 7)+1: US=(UR- 7*(UP-1))-1
9380 FIELD3,(US*32)ASU$,20ASU$(0),4ASU$(1),2ASU$(2),
     4ASU$(3),2ASU$(4):RETURN
9390 'GET RECORD
9400 GOSUB 9370:GET 3,UP:D$=U$( 0):CA=CVS(U$( 1))
     :XC=CVI(U$( 2)):DT=CVS(U$( 3)):L4=CVI(U$( 4)):RETURN
9410 'PUT RECORD
9420 GOSUB 9370:LSETU$( 0)=D$:RSETU$( 1)=MKS$(CA)
     :RSETU$( 2)=MKI$(XC):RSETU$( 3)=MKS$(DT)
     :RSETU$( 4)=MKI$(L4):PUT 3,UP:RETURN
9500 'I/O ROUTINES FOR APPLICATION FILE (D/S/D/B)
9510 'GET FORMAT #1
9520 INPUT#1,L6,L7:RETURN
9530 'PUT FORMAT #1
9540 PRINT#1,L6;",";L7:RETURN
9550 'GET FORMAT #2
9560 INPUT#1,A$,L1,L2,L5:RETURN
9570 'PUT FORMAT #2
9580 PRINT#1,A$;",";L1;",";L2;",";L5:RETURN
9600 'I/O ROUTINES FOR CONTROL FILE (D/S/F/U)
9610 'GET RECORD .
9620 INPUT#4,J1,J2
9621 FORU=1TO9:INPUT#4,SM$(U):NEXT
9622 FORU=1TO9:INPUT#4,AR(U):NEXT
9623 FORU=1TO9:INPUT#4,P(U):NEXT
9625 FORU=1TO3:LINEINPUT#4,Y$(U):NEXT:RETURN
9630 'PUT RECORD
9640 PRINT#4,J1;J2
9641 FORU=1TO9:PRINT#4,SM$(U):NEXT
9642 FORU=1TO9:PRINT#4,AR(U):NEXT
9643 FORU=1TO9:PRINT#4,P(U):NEXT
9645 FORU=1TO3:PRINT#4,Y$(U):NEXT:RETURN
```

COMPARISON CHARTS: A First-Buyer's Guide to Hardware



The comparison charts on the following pages serve to introduce the potential buyer to the salient performance characteristics of some of the latest and best terminals, printers and floppy disk drives currently available from approximately 150 manufacturers.

We did not attempt all-inclusive coverage of the some 300 companies supplying this hardware. That will come in future issues wherein we will provide more in-depth charts that the reader can use to cross reference most of the products in the microcomputer field.

The Reader Service Number column has been included in order to obtain more detailed information on a single product. Circle that number on the reader service card and mail it back to INTERFACE AGE. Each company will respond to your query, but please allow four to six weeks.

If a faster reply is required, a list of the manufacturers and their addresses appears at the end of the survey and we suggest contacting them directly.

FLOPPY DISK DRIVES

	READER SERVICE NUMBER	TYPE				BUS TYPE		SPECIFICATIONS					
		HARD SECTOR	SOFT SECTOR	SINGLE SIDE	DOUBLE SIDE	S100	OTHER	SIZE OF DISK 5¼	SIZE OF DISK 8	NO OF DRIVES	CAPACITY	NO OF TRACKS	NO OF SECTORS
Commodore — Model 2040	264		•	•			•	•		2	.34	35	*
Electrolabs — Model MT-1	265	*	*	•	•	*	*		•	2	.25	*	*
Innotronics Corp. — Model 410	266	•	•	•		•			•	3	.25	77	26
Micro Peripherals Inc. — Model 51	267	•	•	•			•	•		1	.25	40	*
— Model 52	268	•	•		•		•	•		1	.5	80	*
Micromation — Model Megabox	269	•			•	•			•	2	2	*	*
Micropolis — Model 1021-I	270	•		•		•		•		1	.143	35	16
— Model 1021-II	271	•		•		•		•		1	.315	77	16
— Model 1022-I	272	•		•		•		•		1	.143	35	16
— Model 1023-II	273	•		•		•		•		1	.315	77	16
— Model SBVC-55-II	274		•		•	•		•		2	.788	77	20
— Model 1033-II	275	•		•		•		•		2	.63	77	16
— Model 1041-I	276	•		•		•		•		1	.143	35	16
— Model 1041-II	277	•		•		•		•		1	.315	77	16
— Model 1042-I	278	•		•		•		•		1	.143	35	16
— Model 1043-II	279	•		•		•		•		1	.315	77	16
— Model 1053-II	280	•		•		•		•		2	.63	77	16
— Model 1054-II	281	•		•		•		•		4	1.2	77	16
Otto Electronics — Model Add-A-Disk	282	*	*	•		*	*	•		2	81.92K	40	16
PerSci Inc. — Model 277	283	•	•	•		•			•	2	.16	77	*
— Model 299	284	•	•		•	•			•	2	3.2	77	32
Pertec Computer Corp. — Model FD200	285	*	*	•			•	•		1	*	40	*
— Model FD250	286	*	*		•		•	•		1	*	70	*
Remex — Model RFD 4000	287	*	*		•		•		•	1	.16	154	26
Remex — Model RFS 4800	288	*	•		•	•			•	1	1M	155	*
Shugart Associates — Model SA400	289	•	•	•		*	*	•		1	.11	35	*
— Model SA450	290	•	•		•	*	*	†	†	1	219	35	*
— Model SA800	291	•	•	•		*	*		•	1	400KB	77	*
— Model SA850/851	293	•			•	*	*	‡	‡	2	.16	154	*
Terminal Data Corp. — Model SYS 2000	294	*	*	•			•	•		1	.60	*	*

*No specification given
†Disk size is 5.75
‡Disk size is 9.50

TERMINALS

	READER SERVICE NUMBER	TYPE		LINK				SPECIFICATIONS								
		CRT	HARD COPY	RS232	CURRENT LOOP	PARALLEL	OTHER	LINE LENGTH	NO OF CHARACTERS	CHARACTERS/INCH	CHARACTERS/SECOND	LINES/MINUTE	LOWER CASE		SPECIAL FUNCTION KEYS	
													Y	N	Y	N
California Microcomputer — Model 5060	175		•	•				144	88	12	15	*	•		•	
Computer Communications — Model CC-40	176	•	•	•		•		80	128	9	960	*	•		•	
Computer Devices — Model Miniterm 1202	177		•	•	•	•		132	128	16	30	*	•			•
— Model Miniterm 1203	178		•	•	•	•		132	128	16	30	*	•			•
— Model Miniterm 1204	179		•	•	•	•		132	128	16	50	*	•			•
— Model Miniterm 1205	180		•	•	•	•		132	128	16	50	*	•			•
— Model Miniterm 1206	181		•	•	•	•		132	128	16	50	*	•			•
— Model Teleterm 1030	182		•	•				80	64	10	30	*		•		•
— Model Teleterm 1132	183		•	•				132	64	10	30	*		•		•
Computer Transceiver Systems — Model Execuport 4000	184		•	•				136	*	10	30	*	•			•
Data Machines International — Model DMI-40T	185		•	•		•		40	40	10	80	2	•			•
Dataproducts Corporation — Model D-50 KSR	186		•	•	•			158	96	12	47	*	•		•	
Eeco Inc. — Model Editor I	187	•		•	•	•		80	1920	10	19	*	•		•	
Graphtek Corp. — GT2000	188	•		•				80	4000	*	*	*	•		•	
Hazeltine — Model 1410	189	•		•				72	80	8	960	*		•		•
— Model 1420	190	•		•	•			72	80	8	960	*	•		•	
— Model 1500	191	•		•	•			72	80	8	1920	*	•			•
— Model 1510	192	•		•	•			72	80	8	1920	*	•		•	
— Model 1520	193	•		•	•	•		72	80	8	1920	*	•		•	
— Model 1552	194	•		•	•			72	80	8	960	*	•		•	
— Model Mod One	195	•		•	•	•		72	80	8	960	*	•		•	
Industrial Microsystems — Model 20	196	•	•	•				80	96	*	*	*	•		•	
Lear Siegler, Inc. — Model ADM-31	197	•		•	•			80	1920	*	*	*	•		•	
— Model ADM-3A	198	•	•	•	•			80	1920	*	*	*	•		•	
— Model ADM-42	199	•	•	•	•			80	1920	*	*	*	•		•	
Micro Diversions Inc. — Model MAGS	200	•					•	85	85	8	*	800	•		•	
— Model WSVS	201	•					•	86	86	8	*	40K	•		•	
Otto Electronics — Model OE1000	202	•		•	•			64	128	*	30	*	•			•
Telecommunications Services — Model 3000	203	•		•				72	*	*	960	*		•	•	
TeleVideo, Inc. — Model 912B	204	•		•	•			80	96	10	*	*	•			•
— Model 920B	174	•		•	•			80	96	10	*	*	•		•	
Terminal Data Corp. — Model 675	205	•		•		•		64	64	10	9600	*	•			•
Texas Instruments — Model 743	206		•	•	•	•		80	128	10	30	*	•			•
— Model 745	207		•				•	80	128	10	30	*	•			•
— Model 763	208		•	•	•			80	128	10	30	*	•			•
— Model 765	209		•				•	80	128	10	30	*	•			•
— Model 785	210		•				•	80	120	10	120	*	•			•
— Model 787	211		•				•	80	128	10	120	*	•			•

*No specification given

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PRINTERS

	READER SERVICE NUMBER	TYPE						SPECIFICATIONS			
		DAISYWHEEL	DOT MATRIX	THERMAL	ELECTROSTATIC	LINE	OTHER	NO OF CHARACTERS	NO OF COLUMS	CHARACTERS/SECOND	LINES/MINUTE
Addmaster Corporation — Model 56	212						•	*	16	*	180
Anadex, Inc. — Model DP-8000	213		•					96	80	112	84
— Model DP-8000-AP	214		•					96	96	134	84
— Model DP-9500	215		•					96	175	200	*
— Model DP-9501	216		•					96	220	200	*
APF Electronics, Inc. — Model P-40T	217			•				96	40	160	240
Axiom — Model EX-801P	131				•			128	80	160	*
— Model EX-801S	132				•			128	80	160	*
— Model EX-820	133				•			128	80	160	*
C. Itoh Electronics Inc. — Model 1540P	134		•					128	136	125	*
— Model 8300P	135		•					128	132	125	*
California Microcomputer — Model UPOM-ASCII-B	218						•	88	44	10	*
Centronics — Model 700	136		•					64	132	60	13-90
— Model 730	137		•					64	80	100	30
— Model 780	138		•					64	80	60	*
Commodore — Model 2022	219		•					*	80	150	70
Comprint — Model 912	220		•					96	80	225	170
Computer Devices, Inc. — Model Miniterm 1201	221			•				96	132	50	*
Data General Corp. — Model TP-1	139		•					96	132	60	*
Data Machines International — Model DMI-40	222		•					40	*	80	2
Data Wholesale Corporation — Model Qume Sprint 5	223	•						96	132	55	*
Dataproducts Corporation — Model 2230	224					•		96	136	*	300
— Model 2260	225					•		96	136	*	600
— Model 2290	226					•		96	136	*	900
— Model 2470	227					•		96	132	*	1250
— Model 2550	228					•		96	132	*	1500
— Model B-300	229					•		64	132	*	300
— Model B-600	230					•		64	132	*	600
— Model T-80	231					•		96	80	80	*
Datasouth Computer Corp. — Model DS180	140		•					96	132	180	*
Diablo Systems Inc. — Model 1345	141	•							132	40	
— Model 1355WP	142	•						96	to	to	*
— Model 1380	143	•							316	60	
— Model 2300	144		•					96	132	200	*
Eaton LRC — Model 7000	233		•					96	40	60	*
Epson America Inc. — Model M-10	234					•		96	80	*	150
— Model 210	235		•					*	26	*	14

*No specification given

PRINTERS

	READER SERVICE NUMBER	TYPE						SPECIFICATIONS			
		DAISYWHEEL	DOT MATRIX	THERMAL	ELECTROSTATIC	LINE	OTHER	NO OF CHARACTERS	NO OF COLUMS	CHARACTERS/SECOND	LINES/MINUTE
Epson America Inc. — Model 512	236		•					*	40	*	180
— Model 3110	237		•					*	80	150	*
— Model TX-80/TX-80B	238		•					96	80	150	*
Excel — Model TX-80	145		•					96	80	150	*
Hewlett-Packard — Model 9866B	239			•				95	80	*	240
— Model 9876A	240			•				96	80	*	480
Houston Instrument — Model 8210	241				•			96	80	*	2400
— Model 8230	242				•			96	132	*	1400
— Model 8220	243				•			96	132	*	1000
Integral Data Systems Inc. — Model IDS440	146		•					96	132	198	*
John Fluke Mfg. Co. — Model 2030A	244					•		64	*	*	180
Lear Siegler Data Products — Model Series 300	215		•					96	136	180	*
Malibu Design Group Inc. — Model 165	147		•					96	132	165	*
Matchless Systems — Model MS-204	246		•					96	80	125	63
Motorola — Model 781	247		•					64	80	60	120
MPI — Model 88T	248		•					96	132	100	60
Okidata Corporation — Model CP 210	249		•					96	80	110	*
— Model Microline 80	250		•					96	132	80	*
— Model SL 125	251		•					96	132	*	125
— Model SL 160	252		•					96	132	*	160
— Model SL 250	253		•					96	132	*	250
— Model SL 300	254		•					96	132	*	300
Olivetti Corp. — Model PR1370	148		•					96	200	200	*
Printer Terminal Commun. — Model Printerm 877	255		•					95	*	120	80
— Model Printerm 879	256		•					95	*	180	132
PSC — Model PSC 5500	257						•	128	163	55	*
Qantex — Model 6000	258		•					*	132	150	*
Qume Corp. — Model Sprint Micro 3/35	149	•						96	132	35	*
— Model Sprint Micro 3/45	150	•						96	or	45	*
— Model Sprint Micro 3/55	295	•						96	158	55	*
Sigma International, Inc. — Model Impact Date 801	259		•					96	132	132	50
Silver Spur — Model Elpack 805	260		•					96	80	100	*
Texas Instruments — Model 810	261		•					64	132	150	60
— Model 825 RO	262		•					128	132	75	*
Vector Graphic — Model MP	263		•					95	80	150	*

*No specification given

TERMINALS
List of Manufacturers

California Micro Computer
9323 Warbler Avenue
Fountain Valley, CA 92708

Computer Communications
2610 Columba Street
Torrance, CA 90503

Computer Devices
25 North Avenue
Burlington, MA 01803

Computer Transceiver Systems
E66 Midland Avenue, P.O. Box 15
Paranices, NJ 07652

Data Machines International
Terrace Hill
Ithaca, NY 14850

Dataproducts Corporation
6200 Canoga Avenue
Woodland Hills, CA 91365

Eeco Inc.
1601 E. Chestnut Avenue
Santa Ana, CA 92701

Graphtek Corporation
2959 W. Fairmount
Phoenix, AZ 85017

Hazeltine Corporation
Cuba Hill Road
Greenlawn, NY 11740

Industrial Microsystems
628 N. Eckhoff
Orange, CA 92668

Lear Siegler, Inc.
714 N. Brookhurst Street
Anaheim, CA 92803

Micro Diversions, Inc.
5455-D Tyco Road
Vienna, VA 22180

Otto Electronics
P.O. Box 3066
Princeton, NJ 08540

Telecommunications Services
Box 4117
Alexandria, VA 22203

TeleVideo Inc.
3190 Coronado Drive
Santa Clara, CA 95051

Terminal Data Corporation
11878 Coakley Circle
Rockville, MD 20852

Texas Instruments Inc.
P.O. Box 1444, M/S 7701
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Hex Keypad/Display.

Hex Keypad/Display Specifications

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Level "C" Specifications

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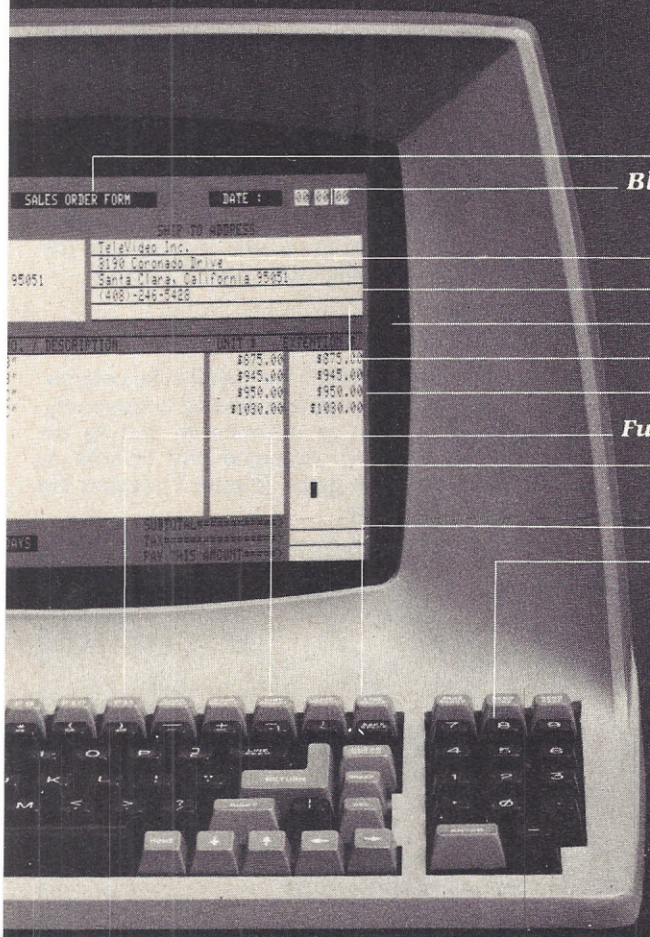
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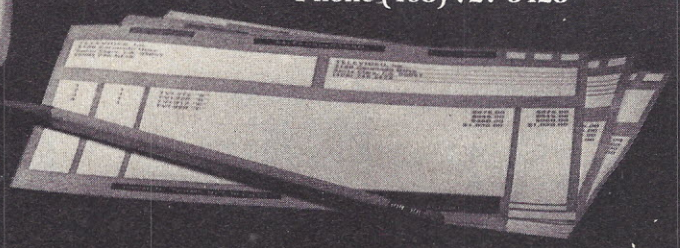
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CIRCLE INQUIRY NO. 45

Programmable Calculator

By M. Patt and L. Fisher
University of Lowell

Two pocket calculator programs are presented for use with the Hewlett-Packard Model 67 (Reverse-Polish) and the Texas Instruments Model SR-52 (Algebraic) programmable pocket calculators. Each program, self-contained and complete, fits on a single magnetic card. The programs enable an operator to quickly evaluate real determinants of sizes two-by-two through six-by-six. Both programs are most accurate when all determinant elements are integers. Errors are generally less than 0.001% for a six-by-six (worst case) determinant with all integer elements.

SOLUTION BY PIVOTAL CONDENSATION

The program written for the HP-67 calculator evaluates the determinant of a square matrix by repeated applications of the process of pivotal condensation.[1,2] This procedure allows for successive reduction in determinant size, finally leaving a two-by-two determinant to be evaluated. Assuming that the pivot elements do not vanish, reduction of a six-by-six determinant is accomplished in four successive steps:

$$\text{Column: } A_1\ A_2\ A_3\ A_4\ A_5\ A_6 \qquad \text{Column: } B_1\ B_2\ B_3\ B_4\ B_5$$

$$\begin{vmatrix} a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{vmatrix} = \frac{1}{a_{11}^4} \begin{vmatrix} b_{21} & b_{22} & b_{23} & b_{24} & b_{25} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} \\ b_{41} & b_{42} & b_{43} & b_{44} & b_{45} \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} \end{vmatrix}$$

$$\text{Column: } C_1\ C_2\ C_3\ C_4 \qquad \text{Column: } D_1\ D_2\ D_3 \qquad \text{Col: } E_1\ E_2$$

$$= \frac{1}{a_{11}^4 b_{11}^3} \begin{vmatrix} c_{11} & c_{12} & c_{13} & c_{14} \\ c_{21} & c_{22} & c_{23} & c_{24} \\ c_{31} & c_{32} & c_{33} & c_{34} \\ c_{41} & c_{42} & c_{43} & c_{44} \end{vmatrix} = \frac{1}{a_{11}^4 b_{11}^3 c_{11}^2} \begin{vmatrix} d_{11} & d_{12} & d_{13} \\ d_{21} & d_{22} & d_{23} \\ d_{31} & d_{32} & d_{33} \end{vmatrix} = \frac{1}{a_{11}^4 b_{11}^3 c_{11}^2 d_{11}} \begin{vmatrix} e_{11} & e_{12} \\ e_{21} & e_{22} \end{vmatrix}$$

To minimize data-memory requirements, all columns of each determinant are normalized. The three-by-three determinant, for example, is normalized column by column:

$$\begin{vmatrix} d_{11} & d_{12} & d_{13} \\ d_{21} & d_{22} & d_{23} \\ d_{31} & d_{32} & d_{33} \end{vmatrix} = (d_{11}d_{12}d_{13}) \begin{vmatrix} 1 & 1 & 1 \\ d_{21}/d_{11} & d_{22}/d_{12} & d_{23}/d_{13} \\ d_{31}/d_{11} & d_{32}/d_{12} & d_{33}/d_{13} \end{vmatrix}$$

Since the first row of normalized determinants always contains only unit elements, these elements need not be stored. Further, by normalizing prior to applying the pivotal condensation method, the need to divide by the n-2 power of the pivot element is obviated since all pivot elements are always unity.

When a zero-normalization element (a_{11}, b_{1j}, c_{1j}, d_{1j}, e_{1j}) appears, it is replaced by a small number according to the general replacement schedule:

Vanishing Element	Replacement
a_{11}	1.0×10^{-4}
b_{1j}, j=1,2,3,4,5	1.1×10^{-5}
c_{1j}, j=1,2,3,4	1.2×10^{-6}
d_{1j}, j=1,2,3	1.4×10^{-7}
e_{1j}, j=1,2	1.5×10^{-8}

With this scheme both vanishing pivot elements and, more generally, vanishing normalization factors are replaced by small numerical values. The need for five different replacement values becomes clear when considering the following example. Suppose that a three-by-three determinant contains a *zero* in positions d_{12} and d_{22}, and a *one* in position d_{21}. The zero-normalizer (d_{12}) is replaced by a small value k:

$$\begin{vmatrix} d_{11} & 0 & d_{13} \\ d_{21} & 0 & d_{23} \\ d_{31} & d_{32} & d_{33} \end{vmatrix} \simeq \begin{vmatrix} d_{11} & k & d_{13} \\ 1 & 0 & d_{23} \\ d_{31} & d_{32} & d_{33} \end{vmatrix}$$

Reducing by pivotal condensation:

$$\begin{vmatrix} d_{11} & k & d_{13} \\ 1 & 0 & d_{23} \\ d_{31} & d_{32} & d_{33} \end{vmatrix} = \frac{1}{d_{11}} \begin{vmatrix} -k & e_{12} \\ e_{21} & e_{22} \end{vmatrix}$$

If e_{12} also vanishes, it should be replaced by a number which is small by comparison with the other elements of the same determinant. Thus, a new (and smaller) zero-replacement should be used in each successive reduction. For greatest accuracy, the zero-replacing constants should be as small as possible. Recognizing that a product of normalization factors will be formed and stored in data-memory, underflow considerations restrict the "smallness" of the zero-replacers. Selecting the numerical value 10^{-4} for the largest zero-replacer (replaces a_{11}), accuracy is generally better than 99.999%.

DATA ENTRY AND MEMORY ALLOCATION (HP-67)

The data elements of the A-matrix are keyed in by column. Thus, column A_1 is keyed in first, followed by columns A_2, A_3, A_4, A_5, and A_6. As soon as columns A_1 and A_2 are available, column B_1 may be computed and column a_2 discarded. A computation flow graph (Figure 1) depicts the "digestion" of columns of data:

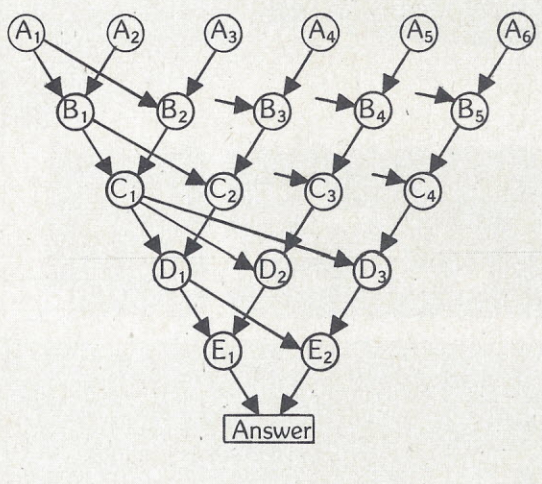


Figure 1. Simultaneous Entry and Processing (digestion) of Data by the Method of Pivotal Condensation.

Notice that "digestion" of column A_6 (the column of the original determinant which is keyed in last) requires that columns A_1, B_1, C_1, and D_1 be available (stored in memory). Computation of the answer also requires that column E_1 be stored. To meet these requirements, data memory has been allocated as follows:

Evaluation of Real Determinants

Table 1. Chart of Memory Allocation as a Function of Time

R_0:	a_{21}/a_{11};	b_{25}/b_{15}. . .e_{22}/e_{12}
R_1:	a_{31}/a_{11};	b_{35}/b_{15}. .
R_2:	a_{41}/a_{11};	b_{45}/b_{15}.
R_3:	a_{51}/a_{11};	b_{55}/b_{15}
R_4:	a_{61}/a_{11}	
R_5:	Partial product of normalization factors	
R_6:	Zero approximator base value	
R_7:	Modified zero approximator	
R_8:	Partial product of normalization factors	
R_9:	$-(n-1)$, where n is determinant size	
R_{10}:	b_{21}/b_{11}	
R_{11}:	b_{31}/b_{11}	
R_{12}:	b_{41}/b_{11}	
R_{13}:	b_{51}/b_{11}	
R_{14}:	b_{22}/b_{12}; c_{21}/c_{11}	
R_{15}:	b_{32}/b_{12}; c_{31}/c_{11}	
R_{16}:	b_{42}/b_{12}; c_{41}/c_{11}	
R_{17}:	b_{52}/b_{12}; b_{23}/b_{13}; c_{22}/c_{12}; d_{21}/d_{11}	
R_{18}:	b_{33}/b_{13}; c_{32}/c_{12}; d_{31}/d_{11}	
R_{19}:	b_{43}/b_{13}; c_{42}/c_{12}; b_{24}/b_{14}; c_{23}/c_{13}; d_{22}/d_{12}; e_{21}/e_{11}	
R_A:	b_{53}/b_{13};	b_{34}/b_{14}; c_{33}/c_{13}; d_{32}/d_{12}
R_B:		b_{44}/b_{14}; c_{43}/c_{13}
R_C:		b_{54}/b_{14}
R_D:	First element a_{1j} while reducing prior column	
R_E:	Normalization factors b_{1j}, c_{1j}, d_{1j}, e_{1j} which are generated and used during reduction of a column	
R_I:	Indirect addressing.	

Time →

KEYSTROKE SEQUENCE FOR HP-67 PIVOTAL CONDENSATION METHOD

Description	Key	Observe
1. To reset for a new problem, press:	a	0.
2. Enter each first column element, followed by:	A	count
3. Enter each second column element, followed by:	B	—
4. third, if any	C	—
5. fourth, if any	D	—
6. fifth, if any	E	—
7. sixth, if any	e	—
8. To request the answer, press:	c	Answer

SOLUTION BY GAUSSIAN ELIMINATION

The program written for the SR-52 calculator evaluates the determinant by a modified Gaussian elimination process[3-4]. Through the systematic addition of rows, this procedure develops a lower-triangular matrix whose determinant is equal to that of the original matrix. The determinant is then evaluated by taking the trace (product of elements on the diagonal) of the lower-triangular matrix. By Gaussian elimination, transformation of a six-by-six determinant is accomplished in a single logical step:

Column: A_1 A_2 A_3 A_4 A_5 A_6 Column: A_1 α_2 α_3 α_4 α_5 α_6

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{vmatrix} = \begin{vmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 \\ a_{21} & \alpha_{22} & 0 & 0 & 0 & 0 \\ a_{31} & \alpha_{32} & \alpha_{33} & 0 & 0 & 0 \\ a_{41} & \alpha_{42} & \alpha_{43} & \alpha_{44} & 0 & 0 \\ a_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & \alpha_{55} & 0 \\ a_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & \alpha_{66} \end{vmatrix}$$

When a zero appears on the diagonal of the transformed matrix, it is replaced by a small number (10^{-6}). Occasionally, a matrix with an unacceptable pattern of elements will be encountered. In such a case, the SR-52 reports a determinant value which is not correct. It is always possible to check the result by interchanging any two columns of the original matrix and trying again. The calculator should report a result which is the negative of the original determinant value. Generally, the SR-52 program will evaluate a six-by-six (worst case) determinant with accuracy exceeding 99.99_7.

DATA ENTRY AND MEMORY ALLOCATION (SR-52)

The data elements of the A-matrix are keyed-in by column. Thus column A_1 is keyed in first, followed by A_2, A_3, A_4, A_5 and A_6. As soon as columns A_1 and A_2 are available, column α_2 may be computed and Column A_2 discarded. A computation flow graph (Figure 2) depicts digestion of columns of data.

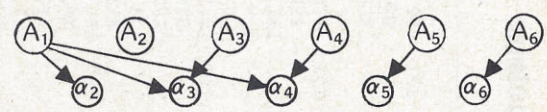


Figure 2. Simultaneous Entry and Processing (digestion) of Data by the Gaussian Elimination Method.

Notice that digestion of column A_6 (the column of the original matrix which is keyed in last) requires that columns A_1, α_2, α_3, α_4, and α_5 be available (stored in memory). These requirements are met by allocating memory as follows:

R_1:	a_{21}/a_{11}	R_{13}: α_{54}/α_{44}
R_2:	a_{31}/a_{11}	R_{14}: α_{64}/α_{44}
R_3:	$a_{41}/_{11}$	R_{15}: α_{65}/α_{55}
R_4:	$a_{51}/_{11}$	
R_5:	a_{61}/a_{11}	**Temporary Pointers**
R_6:	α_{32}/α_{22}	R_0, R_{16}, R_{17}, R_{19}, R_{98}, R_{99}
R_7:	α_{42}/α_{22}	
R_8:	α_{52}/α_{22}	**Intermediate Computations**
R_9:	α_{62}/α_{22}	$R_{64,65,66,67,68,69}$
R_{10}:	α_{43}/α_{33}	
R_{11}:	α_{53}/α_{33}	**Miscellaneous Storage**
R_{12}:	α_{63}/α_{33}	R_{88}: Trace formation
		R_{63}: Entry counter

KEYSTROKE SEQUENCE FOR SR-52 GAUSSIAN ELIMINATION METHOD

Description	Key	Observe
1. To reset for a new problem, press:	A	1.
2. Enter first element of column, followed by:	B	count
3. Enter remaining elements of the column, followed by:	C	count
4. Repeat steps 2 & 3 for each column.		
5. To request the answer, press:	D	Answer

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4. C. Gerald, Applied Numerical Analysis, Addison-Wesley, 1970, p. 145.

Programs follow

APPENDIX A: Program for the HP-67 Calculator

```
  1  LBL A     31 25 11
     FO        35 71 00
     GTO A        22 11
     STF 0     31 51 00
  5  X=0          31 51
     RCL 6        34 06
     STO 5        33 05
     R/S             84
     LBL A     31 25 11
 10  RCL 5        34 05
     /               81
     STO (i)      33 24
     DSZ          31 33
     RCI          35 34
 15  STO 9        33 09
     1               01
     STO 8        33 08
     -               51
     R/S             84
 20  LBL B     31 25 12
     GSB 7a    31 22 07
     1               01
     0               00
     GTO 9a       22 09
 25  LBL C     31 25 13
     GSB 8a    31 22 08
     1               01
     4               04
     GTO 9a       22 09
 30  LBL D     31 25 14
     F1        35 71 01
     GTO D        22 14
     STO D        33 14
     1               01
 35  4               04
     GSB 3     31 22 03
     RCL D        34 14
     LBL D     31 25 14
     GSB 7a    31 22 07
 40  1               01
     7               07
     GTO 9a       22 09
     LBL E     31 25 15
     FO        35 71 00
 45  GTO E        22 15
     STO D        33 14
     1               01
     7               07
     GSB 3     31 22 03
 50  1               01
     7               07
     GSB 4     31 22 04
     RCL D        34 14
     LBL E     31 25 15
 55  GSB 8     31 22 08
     1               01
     9               09
     GTO 9a       22 09
     LBL e     32 25 15
 60  F1        35 71 01
     GTO e     22 31 15
     STO D        33 14
     1               01
     9               09
 65  GSB 3     31 22 03
     1               01
     9               09
     GSB 4     31 22 04
     1               01
 70  9               09
     GSB 5     31 22 05
     RCL D        34 14
     LBL e     32 25 15
     GSB 7a       22 07
 75  0               00
     LBL 9a    31 25 09
     0               00
     SF 2      35 51 02
     RTN          35 22
 80  LBL 7a    31 25 07
     F1        35 71 01
     GSB 9b    31 22 09
     F1        35 71 01
     R/S             84
 85  CF 0      35 61 00
     SF 1      35 51 01
     GTO 7b       22 07
     LBL 8a    31 25 08
     FO        35 71 00
 90  GSB 9b    31 22 09
     FO        35 71 00
     R/S             84
     CF 1      35 61 01
     SF 0      35 51 00
 95  LBL 7b    31 25 07
     STO D        33 14
     RCL 6        34 06
     9               09
     /               81
100  STO 7        33 07
     RCL D        34 14
     X=0          31 51
     V            35 53
     X=0          31 51
105  RCL 7        34 07
     STO D        33 14
     STO x 5   33 71 05
     RTN          35 22
     LBL 5     31 25 05
110  GSB 7c    31 22 07
     1               01
     7               07
     GTO 5        22 05
     LBL 4     31 25 04
115  GSB 7c    31 22 07
     1               01
     4               04
     GTO 4        22 04
     LBL 3     31 25 03
120  GSB 7c    31 22 07
     1               01
     0               00
     GSB 6     31 22 06
     LBL 4     31 25 04
125  GSB 6     31 22 06
     LBL 5     31 25 05
     GSB 6     31 22 06
     LBL 6     31 25 06
     RCL (i)      34 24
130  GTO 2        22 02
     LBL 7c    31 25 07
     STI          35 33
     SF 2      35 51 02
     9               09
135  STO / 9   33 81 07
     V            35 53
     RTN          35 22
     LBL 9b    31 25 09
     RCL D        34 14
140  /               81
     LBL 2     31 25 02
     X,Y          35 52
     X,I          35 24
     V            35 53
145  RCL (i)      34 24
     -               51
     ISZ          31 34
     V            35 53
     X,I          35 24
150  A            35 54
151  F2        35 71 02
     GTO 2b       22 02
     RCL E        34 15
     /               81
155  STO (i)      33 24
     ISZ          31 34
     LBL d     32 25 14
     V            35 53
     V            35 53
160  X,I          35 24
     STI          35 33
     ISZ          31 34
     A            35 54
     RTN          35 22
165  LBL 2b    31 25 02
     X≠0          31 61
     GTO 2c       22 02
     V            35 53
     RCL 7        34 07
170  LBL 2c    31 25 02
     STO x 8   33 71 08
     STO E        33 15
     GTO d     22 31 14
     LBL c     32 25 13
175  RCL 9        34 09
     2               02
     X               71
     STI          35 33
     GTO 7d       22 07
180  0               00
     GTO 9c       22 09
     GSB e     32 22 15
     GTO c     22 31 13
     GSB E     31 22 15
185  GTO c     22 31 13
     GSB D     31 22 14
     GTO c     22 31 13
     GTO 8b       22 08
     LBL 7d    31 25 07
190  GTO (i)      22 24
     LBL 9c    31 25 09
     GSB 3     31 22 03
     0               00
     GSB 4     31 22 04
195  0               00
     GSB 5     31 22 05
     RCL 0        34 00
     P/S          31 42
     RCL 9        34 09
200  -               51
     P/S             31 42
     STO x 5   33 71 05
     GTO 8b       22 08
     LBL c     32 25 13
205  RCL D        34 14
     STO / 5   33 81 05
     LBL 8b    31 25 08
     RCL 8        34 08
     STO x 5   33 71 05
210  RCL 5        34 05
     DSP 0        23 00
     RND             31 24
     PRINT (67)→35 84
     R/S             84
215  LBL a     32 25 11
     CL REG       31 43
     CF 0      35 61 00
     CF 1      35 61 01
     EEX             43
220  4               04
     CHS             42
     STO 6        33 06
     CLX             44
224  RTN          35 22
```

APPENDIX B: Program for the SR-52 Calculator

```
  0 01 1
    44 SUM
    09 9
    08 8
    44 SUM
  5 01 1
    09 9
    44 SUM
    06 6
    03 3
 10 43 RCL
    06 6
    03 3
    56 rtn
    46 LBL
 15 18 C'
    36 IND
    43 RCL
    09 9
    08 8
 20 55 ÷
    36 IND
    43 RCL
    09 9
    09 9
 25 56 rtn
    46 LBL
    10 E'
    48 EXC
    06 6
 30 04 4
    49 PROD
    01 1
    08 8
    56 RTN
 35 46 LBL
    13 C
    36 IND
    42 STO
    09 9
 40 08 8
    06 6
    03 3
    42 STO
    09 9
 45 09 9
    43 RCL
    09 9
    08 8
    75 -
 50 06 6
    04 4
    95 =
    55 ÷
    09 9
 55 09 9
    85 +
    43 RCL
    09 9
    07 7
 60 95 =
    42 STO
    01 1
    07 7
    43 RCL
 65 01 1
    06 6
    75 -
    01 1
    44 SUM
 70 09 9
    09 9
    43 RCL
    09 9
    09 9
    95 =
    22 INV
    80 IFPOS
    01 1
    02 2
 80 03 3
    43 RCL
    09 9
    09 9
    75 -
 85 43 RCL
    09 9
    08 8
    95 =
    80 IFPOS
 90 01 1
    02 2
    03 3
    01 1
    00 0
 95 00 0
    49 PROD
    01 1
    07 7
    18 C'
100 75 -
    36 IND
    43 RCL
    01 1
    07 7
105 95 =
    36 IND
    42 STO
    09 9
    08 8
110 22 INV
    90 IFZRO
112 00 0
    06 6
    04 4
    06 6
    94 +/-
117 22 INV
    28 Log
    41 GTO
    01 1
    00 0
122 06 6
    43 RCL
    09 9
    08 8
    75 -
127 43 RCL
    01 1
    06 6
    75 -
    02 2
132 95 =
    80 IFPOS
    01 1
    04 4
    05 5
137 36 IND
    43 RCL
    09 9
    08 8
    49 PROD
142 01 1
    08 8
    86 RSET
    18 C'
    95 =
147 36 IND
    42 STO
    01 1
    09 9
    86 RSET
152 46 LBL
    12 B
    22 INV
    90 IFPOS
    01 1
157 06 6
    03 3
    06 6
    92 +/-
    22 INV
162 28 Log
    10 E'
    01 1
    44 SUM
    01 1
167 06 6
    01 1
    00 0
    00 0
    43 RCL
    00 0
    00 0
    49 PROD
172 00 0
    00 0
    43 RCL
    00 0
    00 0
177 42 STO
    01 1
    09 9
    06 6
    04 4
182 42 STO
    09 9
    08 8
    86 RSET
    46 LBL
187 11 A
    25 CLR
    43 RCL
    09 9
    07 7
192 42 STO
    00 0
    00 0
    06 6
    02 2
197 42 STO
    01 1
    06 6
    01 1
    42 STO
202 01 1
    08 8
    42 STO
    06 6
    04 4
207 86 RSET
    46 LBL
    14 D
    10 E'
    43 RCL
212 01 1
    08 8
    57 fix
    04 4
    44 SUM
217 00 0
    52 EE
    56 RIN
    00 0
    91 RUN
222 70 IFERR
    40 x²
```

Design of an M6800 Based

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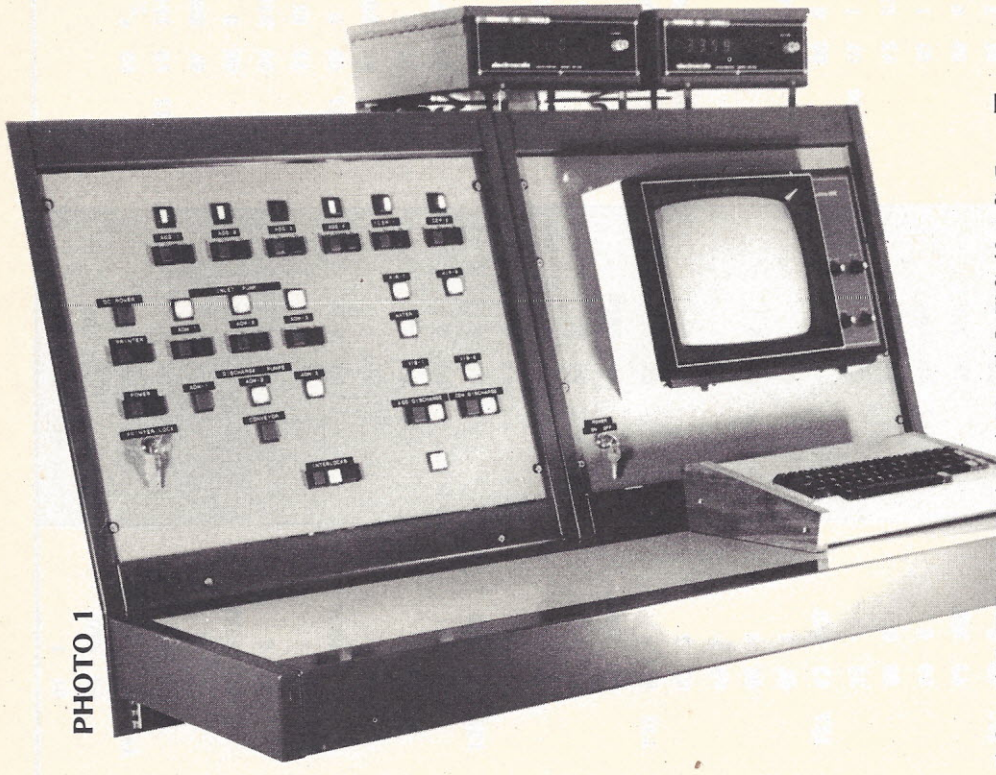


PHOTO 1

INTRODUCTION

The M-6800 has been successfully used as a real time process controller for automatic weigh batching systems. The weigh batchers are marketed by MCM Systems to ready mix cement producers and are also rapidly gaining acceptance in other applications which require precision batching of dry material and fluids for operator selected mix designs.

The MCM Systems unit, illustrated in Figure 1, is an integrated process control system consisting of a manual control panel and a process control computer with appropriate interfaces to material batching control and measurement circuits. In this application the manual control panel provides full manual back up control for all material batching processes. However, the normal mode of operation is full automation under control of the processor.

This article describes the design and optimization of an M-6800 based controller for the system. Following a brief

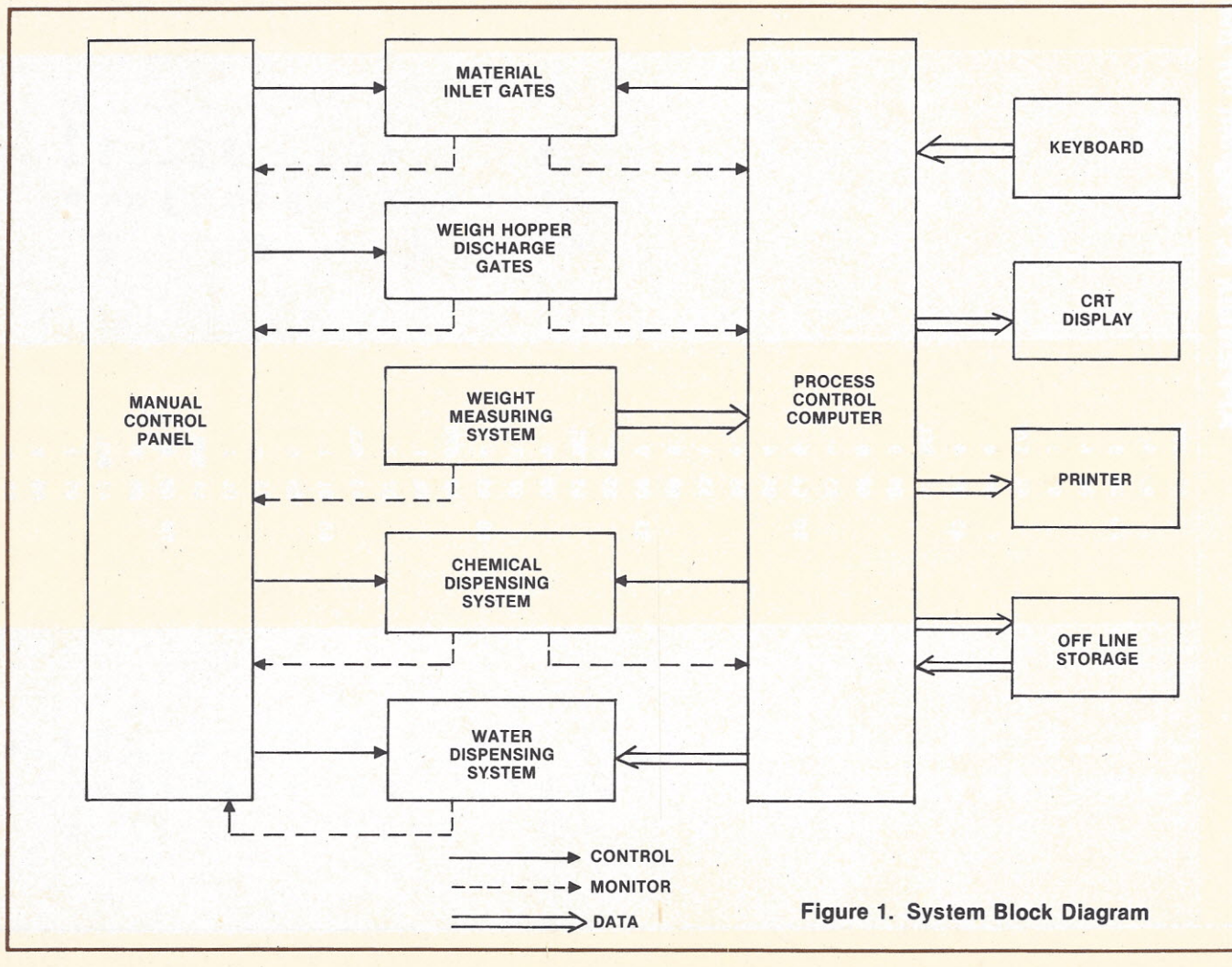


Figure 1. System Block Diagram

Automatic Weigh Batching System

overview of the batching process the hardware and software design processes are reviewed.

MATERIAL BATCHING REQUIREMENTS

Precision batching of materials within a cement plant require a sequence of mechanical gate openings and closings for the inlet of aggregate and cement materials into central weigh hoppers in accordance with a prescribed mix design. Also, when required for the mix, air entraining fluids (admixtures) are batched into holding vials for subsequent discharge into the cement. The controller which automates these processes has been designed to meet cement industry batching standards. This necessitates that within a given batching cycle, material batch weights must be held within specified tolerances. If an out of tolerance condition occurs within a batching cycle the controller must stop the cycle, lock out machine controls and await the manual intervention to restart the batch, following correction of the error condition.

CONTROL PROCESSOR REQUIREMENTS

The controller for the batching system is the master executive for the weigh batching process. It controls all mix design data input, schedules the batching and handles batch recycling. It also detects batching errors and external plant failures.

At the beginning of a process, the system accepts operator inputs of material batch weights. These may either be numeric keyins in response to processor generated prompts or standard mix design material parameters which are recalled from permanent storage. Following the data input mode it computes all batching tolerances, displays all material parameters and prompts the operator to start the cycle.

In response to the operator initiated start code, the system executes the batch cycle. This consists of a sequential opening and closing of various material inlet gates. In each case the close command is generated on the basis of accumulated weight during the material inlet process.

At the completion of the batch cycle the system prints a ticket which shows target batch weights and actual batch weights and header data such as a date time code and customer name and address. It then prompts the operator to either recycle the current batch or initiate a new batch.

COMPUTER DESIGN

The design process for the controller was performed within the following tasks:

1. Processor architecture and external interface design.
2. Software design.
3. System integration and testing.

Our design activities in each of these areas are described in the following paragraphs.

Processor Architecture and External Interfaces

Early in the system design process we chose to implement the controller with an off-the-shelf M-6800 system. The M-6800 was chosen for its versatile I/O structure. The decision to use this system followed a make versus buy analysis which showed overall engineering costs to be minimized through the use of a suitable off-the-shelf mainframe. Following a detailed investigation of candidate M-6800 systems, we chose the GIMIX mainframe for the following reasons:

The Best Reason to buy our General Ledger is our Tax Program. Designed by CPA's, more professionals used our micro-computer Federal Tax Package this year than any other.

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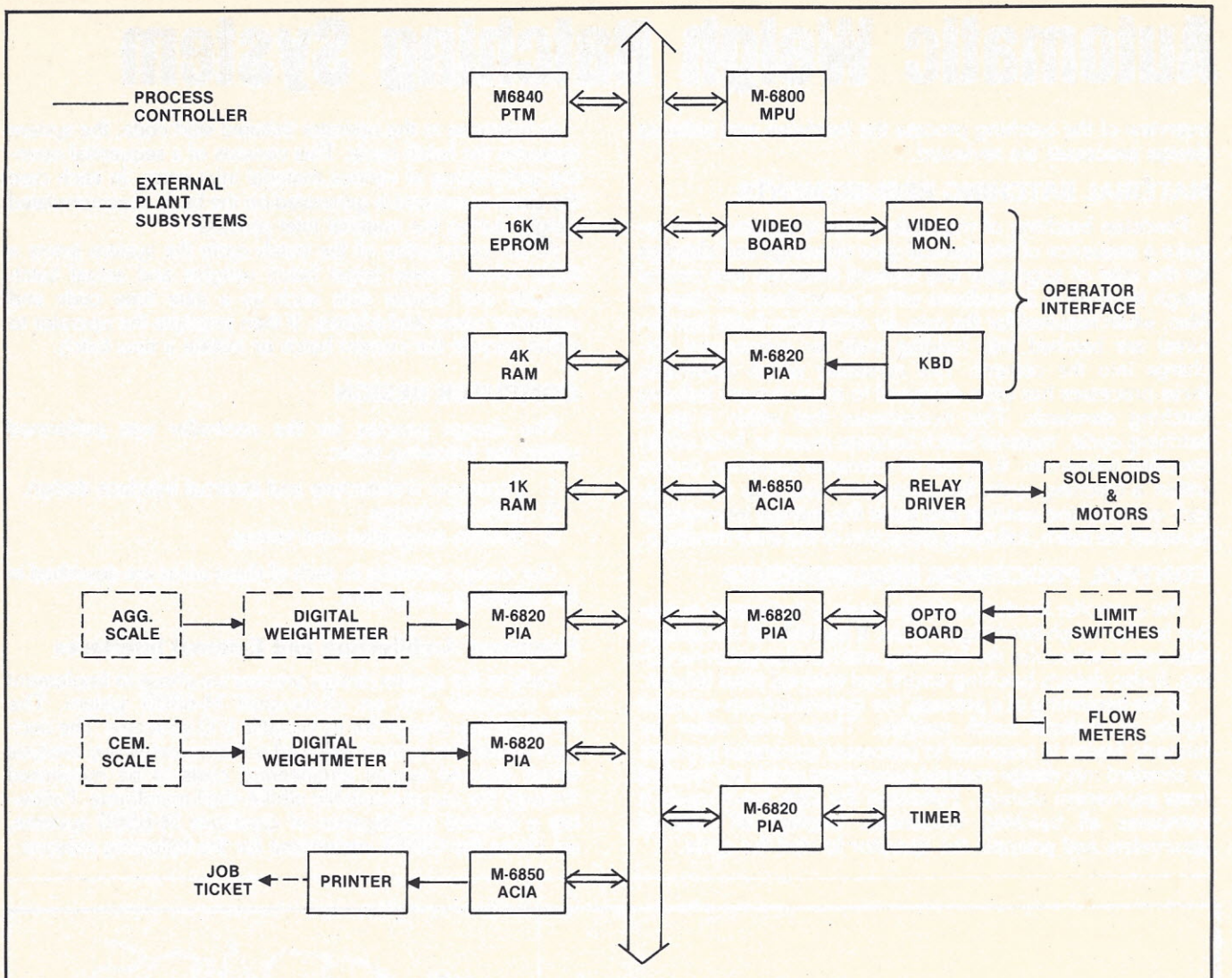


Figure 2. System Architecture

1. The GIMIX system is built to the highest quality commercial standards. This minimizes life cycle costs for the controller.
2. The GIMIX power supply offers the best overall AC line regulation for operation within the hostile industrial control environment.
3. The GIMIX relay driver board and opto board are ideally suited as the primary control system interface elements for this application.

The computer hardware configuration for the controller and its external interface is illustrated in Figure 2. The AC power switching to actuate plant functions is performed by the relay driver board. This unit receives computer initiated switching commands via the ACIA port and controls the switching of General Electric RR-8 relays. The various elements of the power relay array interface with solenoids for opening and closing of mechanical material inlet gates and with motors for controlling fluid pumps.

The opto board interfaces with external limit switches associated with mechanical gate openings and closures. This enables the AC switching subsystem to be closed loop in that failure to detect a gate opening or closure following a switching command, constitutes an external plant error condition. Upon detection of the error the system executes an error processing mode.

The scale subsystem components are Electroscale Inc. DR-525 digital weighmeters. Each of these interface with the processor via a PIA digital I/O port. During a weigh-in process, BCD representations of aggregate and cement weights are read into the system from these units.

Flow meters are used to measure the accumulated volume of fluid during admixture and water input process. These units measure volume delivered in terms of successive switch closures. The output of each flow meter is read into the processor through one port on the GIMIX opto board. This enables a special software routine to count the number of successive detected switch closures during an admixture input process. Hence, when the detected fluid volume reaches its target value, a shut off command is sent to the pump motor via the relay driver board.

Certain functions within the process require elapsed time measurement. The GIMIX programmable timer which resides on their eight-port PIA board was selected for this function. This enables software control of the timer and precise measurement of elapsed time.

The system also requires an accurate measurement and recording of the time of day at the completion of each batch cycle. This is performed very nicely by the M-6840 PTM which is on the GIMIX CPU board. The master control program resides on two 8K EPROM boards. This eliminates the necessity for floppy disk drives or tape drives which are susceptible to failure within this dusty industrial environment.

The system also uses 4K of volatile RAM for temporary storage of data values and scratch pad memory. In addition, we included 1K of non-volatile RAM for permanent storage of mix design data.

Software Development

All software development was performed on a GIMIX system equipped with dual Smoke Signal Broadcasting mini floppy disk drives. The SSB external storage subsystem was selected for the inherent reliability of the floppy disk controller board. System software tools included GMXBUG, SSB DOS68.31, the SSB editor/assembler and the Microware Systems Inc. ABASIC compiler.

All software components which handle interfaces with external subsystems were written in M-6800 assembly language. These include the relay driver and opto handlers, the digital weighmeter handler and the elapsed time controller. The main control program which handles operator I/O and controls the batching sequence was written in ABASIC. We selected the Microware Systems ABASIC compiler for this application since it produces efficient machine code, which is readily adaptable to the EPROM environment. The use of this compiler was a major factor in the success of this project.

The system uses segments of GMXBUG for initialization and operator I/O. We performed minor modifications to GMXBUG in order to post special screen formats during system initialization.

We paid particular attention to the design of the display and operator interface segment of the software since the weigh batching system must be operated by personnel who are not familiar with computer operations. To achieve our design goal of having a simplified operator interface we chose a tree structured menu system which enables the operator to select a particular processing mode from a displayed menu of processing options. Also during the data input mode, the system displays all mix design parameters following operator key in of the data. This presents the operator with a summary of the data which he has entered into the system and enables him to make corrections before the system enters the autobatch mode.

System Integration and Testing

The weigh batching unit prototype hardware which is illustrated in Photo 1 has been installed in the Midstate Ready Mix Inc. plant in Oneida, New York. It has been successfully integrated with plant electro mechanical controls and has underdone extensive testing for the past several months. The test results show that the system is capable of holding cement batching tolerances within one percent of target weights over a target range from 600 to 10,000 pounds and aggregate tolerances within two percent of target weights over a target range from 1,000 to 30,000 pounds.

The unit also serves as a useful information system for the cement plant operator in the daily operations.

CONCLUSIONS

The success of this project demonstrates how a relatively inexpensive off-the-shelf microcomputer system can be structured to perform a set of real time process control functions in a difficult industrial control environment. Development of this controller was performed within the constraints of a low engineering budget. The key ingredients of this successful project were:

1. Application of good systems engineering and computer engineering techniques in the translation of detailed requirements into an efficient structure for the controller.
2. The selection of reliable computer hardware which can operate within this hostile industrial control environment.
3. The selection and judicious use of sound software development tools.□

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My TRS-80 Likes Me

By Bob Albrecht

Copyright 1980 by Bob Albrecht

We began this series with simple verbal and graphics activities, then switched to number patterns. Now, we return to verbal and graphic stuff. If you haven't been following along since we began in the August/September 1979 issue, we suggest you get the eight-page booklet *My TRS-80 Likes Me. . .a resource guide for the elementary teacher.* It's available free from Sharon Ross, Radio Shack Circulation, Department 3, 1300 Tandy Center, Fort Worth, TX 76102.

NAME BLINKER

```
10 CLS
20 INPUT "WHAT IS YOUR NAME";A$
30 INPUT "WHERE SHOULD I BLINK IT";N
40 CLS
50 PRINT@N,A$;          Name ON
60 GOSUB 100            at position N
70 CLS                  Name OFF
80 GOSUB 100            (everywhere)
90 GOTO 40              Do it again
100 LET T = 100         Time delay
110 FOR Z = 1 TO T
120 NEXT Z
130 RETURN
```

When the computer asks WHERE SHALL I BLINK IT? You enter a number from 0 to 1023. What happens if you don't enter an integer from 0 to 1023? Try it and find out. Especially if you are working with kids, have them try it and find out. Always: Experiment!

NAMERUNNER

```
10 CLS
20 INPUT "WHAT IS YOUR NAME";A$
30 FORK = 0 TO 1023
40 CLS
50 PRINT @K,A$;
60 NEXT K
70 GOTO 30
```

Try it. Too fast? Probably, so add a time delay, as follows.

```
55 FOR Z = 1 TO 10 : NEXT Z
```

Slower yet? Try

```
55 FOR Z = 1 TO 99 : NEXT Z
```

HYPERSPACE NAME

RUN this program. Your name will appear somewhere on the screen, then disappear (into Hyperspace?), reappear, disappear, reappear. . .here, there, anywhere on the screen.

```
10 CLS
20 INPUT "WHAT IS YOUR NAME";N$
30 CLS
40 X = RND(1023)
50 PRINT@X,N$;
60 T = 100
70 FOR Z = 1 TO T
80 NEXT Z
90 GOTO 30
```

Hmmm. . .wonder what would happen if we change line 90 to 90 GOTO 40. Do it!

STARFALL

```
100 CLS
110 OVER = RND(127)
120 DOWN = RND(47)
130 SET(OVER,DOWN)
140 IF INKEY =""THEN 110
150 IF INKEY =""THEN 150
160 GOTO 110
```

In lines 140 and 150, do not put a space between the quotation marks.

```
140 IF INKEY$ =""THEN 110
```

When I Teach Kids How to Use It Part 8

When there is nothing between the quotes ("") this is an empty string. It is much like the empty set. There is nothing between quotation marks — the empty string is a nothing string. The empty set contains no elements.

RUN STARFALL. The screen will begin filling with "stars." To stop the action, press almost any key. Stargaze, if you wish. Then, press almost any key. More stars will appear.

WALKABOUT

```
100 CLS
110 OVER = 64
120 DOWN = 24
130 SET(OVER,DOWN)
140 A = RND(3) — 2
150 B = RND(3) — 2
160 OVER = OVER + A
163 IF OVER < 0 THEN OVER = OVER + 1
167 IF OVER > 127 THEN OVER = OVER — 1
170 DOWN = DOWN + B
173 IF DOWN < 0 THEN DOWN = DOWN + 1
177 IF DOWN > 47 THEN DOWN = DOWN — 1
180 IF INKEY$="" THEN 130
190 IF INKEY$="" THEN 190 ELSE 130
```

Try this program. Watch what happens. Perhaps it is a meandering painter, going sometimes left, sometimes right, sometimes up, sometimes down.

What do you see? An angular cloud? A castle? A crystal flower? A city on a hill? If you see something you like, press almost any key. The computer will stop. . .the pattern remains on the screen. Look at it, photograph it, whatever. Then press almost any key. The pattern continues to grow.

HAPPY BIRTHDAY, MOTHER

```
100 REM**A BIRTHDAY CARD FOR MOTHER
110 CLS
200 REM**DRAW LINES TOP AND BOTTOM
210 FOR OVER = 0 TO 127
220 SET(OVER, 0)
230 SET(OVER, 47)
240 NEXT OVER
300 REM**DRAW LINES ON LEFT AND RIGHT
310 FOR DOWN = 0 TO 47
320 SET(0, DOWN)
330 SET(127, DOWN)
340 NEXT DOWN
400REM**THE HAPPY BIRTHDAY MESSAGE
410 PRINT @ 348, "HAPPY";
420 PRINT @ 475, "BIRTHDAY";
430 PRINT @ 604, "MOTHER";
500 REM**WAIT A BIT, THEN DO IT AGAIN
510 T = 1000
520 FOR Z = 1 TO T : NEXT Z
530 GOTO 110
```

You, of course, can change the message to MERRY CHRISTMAS, SANTA or HAPPY UNBIRTHDAY, GANDALF or ???

Or change lines 210 and 310 as follows.

```
210 FOR OVER = 0 TO 127 STEP 2
310 FOR DOWN = 0 TO 47 STEP 2
```

SIMPLE SCRIBBLE

```
100 REM**SCRIBBLE ON THE SCREEN
110 CLS
120 OVER = 64
130 DOWN = 24
200 REM**TURN ON A LIGHT AT OVER, DOWN
210 SET(OVER,DOWN)
300 REM**WAIT FOR SOMEONE TO PRESS A KEY
310 K$=INKEY$ : IF KEY$=""THEN 310
400 REM**IF KEY WAS R OR L, CHANGE OVER
410 IF K$="R" THEN OVER = OVER + 1
420 IF K$="L" THEN OVER = OVER — 1
500 REM**IF KEY WAS U OR D, CHANGE DOWN
510 IF K$="D" THEN DOWN = DOWN + 1
520 IF K$="U" THEN DOWN = DOWN — 1
600 GOTO 210
```

When you RUN this program, a single tiny light will come on near the center of the screen. Press the 'R' key a few times. The TRS-80 moves the light to the right, and paints a line along the way.

Then press 'D' a few times. The line prints downward. OK, try 'L' for left and 'U' for up. Got it? Good. . .scribble away.

Beware! If you go too far right, or too far left, or too far up or too far down, you will get an ? FC ERROR IN LINE 210. We will fix that someday, sometime.

WANDERING STAR

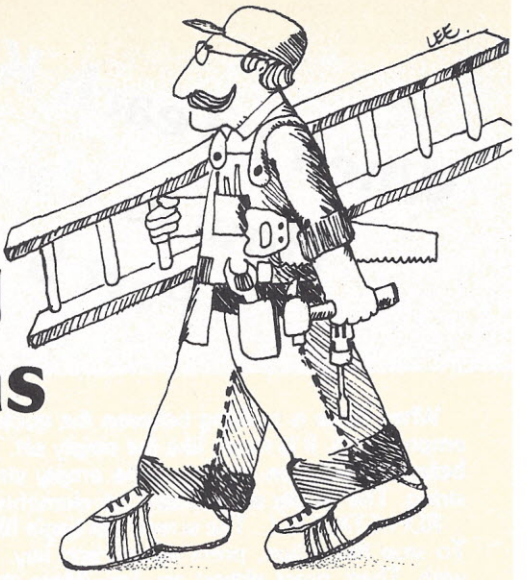
```
100 REM**WANDERING STAR
110 CLS
200 REM**COSMIC DUST
210 FOR K = 1 TO 200
220 PRINT @ RND(1022),".";
230 NEXT K
300 REM**WANDERING STAR APPEARS
310 X=480
320 PRINT @X, "*";
400 REM**WANDERING STAR RESTS
410 T = 2000
420 FOR Z=1 TO T : NEXT Z
500 REM**WANDERING STAR WANDERS
510 R=RND(4)
520 IF R=1 THEN X2=X+1
530 IF R=2 THEN X2=X—1
540 IF R=3 THEN X2=X+64
550 IF R=4 THEN X2=X—64
560 PRINT @X," ";
570 IF X2<0 OR X2>1022 THEN 910
580 X=X2
590 PRINT @X,"*";
600 T = 200
610 FOR Z = 1 TO T : NEXT Z
620 GOTO 510
900 REM**WANDERING STAR DISAPPEARS
910 PRINT @0, "OOPS! WANDERING STAR HAS"
920 PRINT "LEFT THIS UNIVERSE."
930 GOTO 930
```

Eventually, wandering star reaches the edge of the screen and disappears. Despair not! Wandering Star will return.

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Using and Building Micro-Based Systems

Chapter Five

By David Marca, Associate Editor

COMPONENTS OF APPLICATION SOFTWARE

We've progressed far enough in this series where taking stock now will be helpful for both review of past material covered and for getting a feel of where to proceed. During the first four tutorials, we looked at system development principles and rudiments of the FORTRAN language. We've done enough programming to allow us to understand FORTRAN well enough to implement real applications.

Having this understanding of a general system development framework and FORTRAN language specifics, we can now concentrate our attention to the as yet unaddressed "middle" area — software applications (Figure 1).

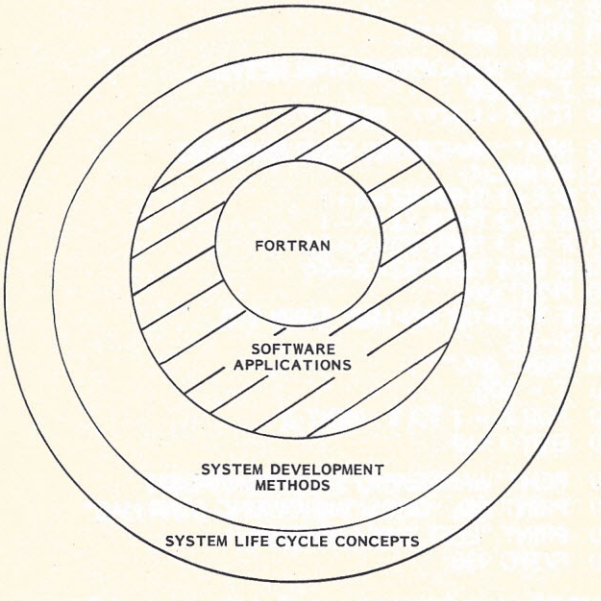


Figure 1. Technical Areas of this Tutorial Series.

Before venturing too far, we should use the experience of others to help us identify the major parts of application software. Some have identified Data Management and User Interface (Figure 2) as parts of application software logic which can be understood and implemented *separate* from the details of the actual application.[1] User Interface concepts will be covered in chapters seven and eight. Data Management will be investigated in nine and ten. Application Logic is so heavily related to the rules and operations of any business, that it cannot be properly covered in this series because of its immense scope.

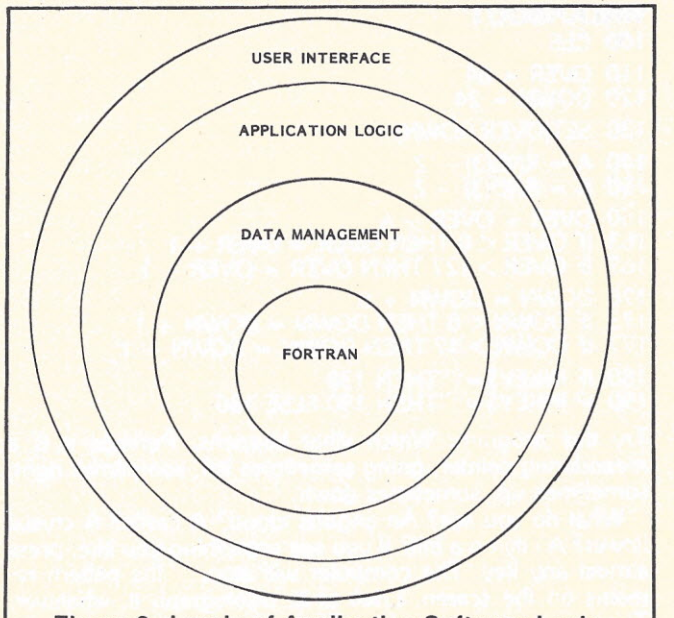


Figure 2. Levels of Application Software Logic

Each of the parts do, however, rely upon the concepts of data structuring in order to do their respective job. For this reason, this article and article six will concentrate on those essential concepts. Programs will be given in both articles which show how to apply data structuring principles in FORTRAN.

This article will concentrate on general concepts of program composition and data structuring. Article six will investigate refinements of those general concepts with a heavier emphasis on actual applications. Lastly, it should be noted that *volumes* of material have been published on this topic. The objective of this article will be to provide a reasonable overview (see outline in Figure 3) together with adequate references for your future study.

1.0 INTRO
2.0 FUNDAMENTAL PARTS OF COMPUTER PROGRAMS
- 2.1 DATA
- 2.2 STRUCTURE
- 2.3 ALGORITHM

3.0 DATA CONCEPTS
- 3.1 THE CONCEPT OF TYPE
- 3.2 PRIMITIVE FORTRAN DATA TYPES
 - 3.2.1 CONSTANTS
 - 3.2.2 VARIABLES

4.0 STRUCTURE CONCEPTS
- 4.1 CHOICE OF REPRESENTATION
- 4.2 PRIMITIVE FORTRAN STRUCTURES
 - 4.2.1 SCALARS
 - 4.2.2 ARRAYS
 - 4.2.2.1 1-D ARRAYS
 - 4.2.2.2 2-D ARRAYS
 - 4.2.2.3 3-D ARRAYS
- 4.3 THE SUBSCRIPT CONCEPT
 - 4.3.1 SUBSCRIPT RULES
 - 4.3.1.1 DEFINING ARRAYS
 - 4.3.1.2 USING ARRAYS
- 4.4 ADVANCED STRUCTURES
 - 4.4.1 THE RECORD PRIMITIVE
 - 4.4.2 THE LINKED LIST CONCEPT

5.0 ALGORITHM CONCEPTS AND SPECIFICS
- 5.1 THE ALIAS-ALIBI CONCEPT
- 5.2 BUILDING ARRAYS
- 5.3 SEARCHING ARRAYS
- 5.4 SORTING ARRAYS
 - 5.4.1 STRAIGHT INSERTION SORT
 - 5.4.2 BUBBLE SORT

6.0 SUMMARY

Figure 3. Outline for Chapter Five

Before we begin, a few words about the organization of this article may help you more easily read and understand its contents. Concepts are presented first, and the majority of related programs are presented last. Reading the article front to back will give you a step-by-step development of facts. This article is also broken into subsections with a bold title for each major concept. Use these bold labels to quickly find information about a single concept, especially when you need to flip back while reading the programs. As a last suggestion, a second complete reading should provide a deeper understanding.

FUNDAMENTAL PARTS OF COMPUTER PROGRAMS

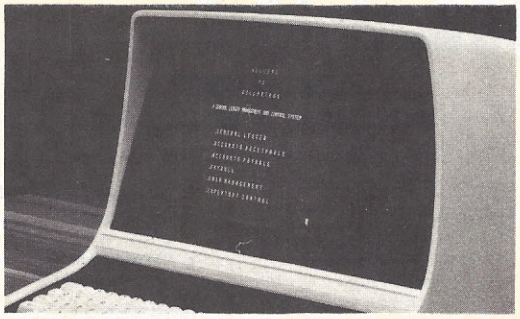
We have already taken a look at the parts of application programs from a particular viewpoint (Figure 2) that helped to explain the organization and content of this article. Another view of computer program composition can help us to present data structuring concepts. Since the concepts we wish to present are extremely basic in nature, the parts of computer programs we identify must be just as basic. Thus we pick the *most* basic components of a computer program: data, structure, and algorithm.

Data

We can define data as a collection of facts, numbers or symbols. It is the raw stuff that computer programs use and manipulate.[2] The most interesting property of data is that it reflects a situation about the real world. In our case, data represents things important to a business, such as dollars, gallons, feet, degrees, etc. A proper set of relevant data can simplify and summarize a real-world problem to the point where a computer program can realize a solution to the problem.

Structure

Structure is organization. When we program, we try to do *purposeful* organization so that our programs will solve the problem at hand. Structure can be given to *both* data and algorithm. The concepts of Structured Programming are the result of people's attempts to apply organization to programming statements. The concepts of data structures are similarly the results of data organization that has proven to be



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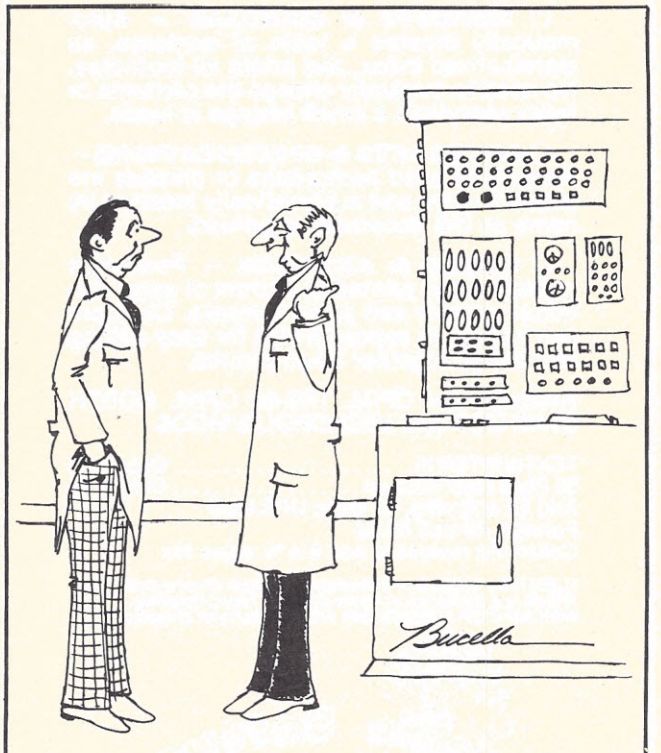
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usable by current programming languages and workable on current hardware technology.

Algorithm

An algorithm is "a set of rules which gives a sequence of operations for solving a specific type of problem, *and* has five important features:

1. *Finiteness* — it must always terminate after a finite number of steps,
2. *Definiteness* — each step must be unambiguously specified,
3. *Input* — it has zero or more inputs,
4. *Output* — it has one or more outputs.
5. *Effectiveness* — all steps can, in principle, be done exactly and in a finite length of time by a man using paper and pencil."[5]

In other words, an algorithm is *like* a recipe. It is a collection of actions to be performed and/or decisions to be made in order to achieve a specific goal. Within the context of a business system, an algorithm usually represents the workings of a specific part of an application.

Now, having defined and gotten a feel for the basic components, a closer look at each should explain how *all* three contribute to making up a computer program.

DATA CONCEPTS

Within the context of a computer program, data is both organized and manipulated. The individual pieces of data are organized according to structure rules defined by the programmer. Data is also manipulated by an algorithm, and is done so in various ways. Data and structures of data can be: read in, written out, created, modified, or destroyed by an algorithm. The sole purpose of this manipulation is to take data in its "raw" form and transform it into *useful* information.

All programming languages allow the programmer to structure and manipulate defined types of data. The data types allowed depend upon the set of applications that could be implemented by the language (remember FORTRAN was designed for scientific problems). Before looking at the different data types allowed by FORTRAN, let's define "type."

The Concept of Type

All data can be classified into different groups or collections. This classification is done according to characteristics exhibited by a particular piece of data. Data having similar characteristics belong to the same group. For example, any whole number (positive, negative or zero) having precision to five digits in the range −32768 to +32767 inclusive is considered to be of type INTEGER according to our version of FORTRAN. Thus, whenever a data type is defined for a language, the characteristics of data are always carefully specified.

Primitive FORTRAN Data Types

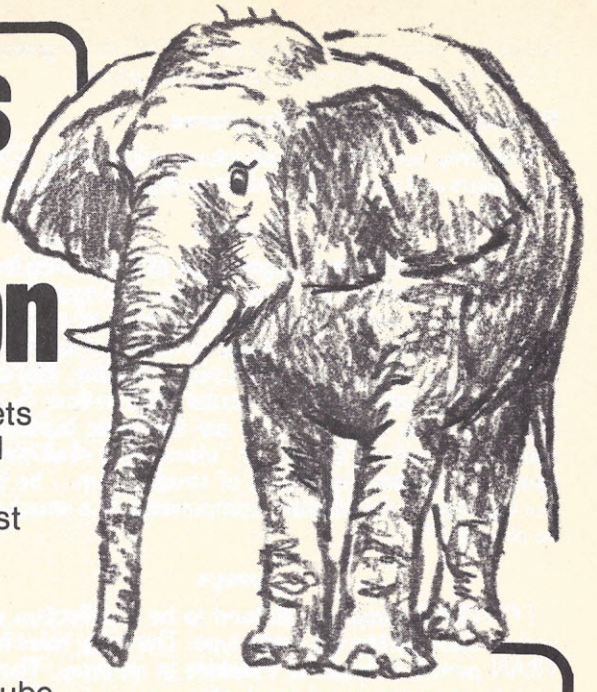
The two most general categories of data in the FORTRAN language are constants and variables. Constants represent data whose value *never* changes. Variables represent data that can take on many values over the course of time. These general types do not adequately categorize data to be used by a FORTRAN program. Each general category, therefore, has a specific set of primitive types which we will now investigate.

Constants

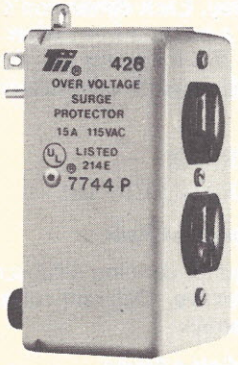
A constant is explicitly identified by its value in a FORTRAN program. There are five allowable primitive types of FORTRAN constants:

- INTEGER — whole numbers (e.g., 107, −99)
- REAL — numbers having: a decimal point, (possibly) a fractional part, and (possibly) a part representing a power of ten (e.g., 7., −11.33, +5.7E9)

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- DOUBLE - same as a real constant, but a larger value can be represented (e.g., 115976., -137925.678, -73.3D10)
- LOGICAL — can only represent the boolean values of true and false (e.g., .TRUE., .FALSE.)
- LITERAL — any number of characters enclosed by single quotes (e.g., 'THIS IS A LITERAL')

The above are the five primitive types of constants supported by all FORTRAN IV compilers. Other primitive types may be allowed depending on the specifics of your microcomputer and compiler.

Variables

A variable is identified by a symbolic name. This name is a unique string of alphanumeric characters, the first character must be a letter (e.g., BAL, AREA, H3P5). There are four allowable primitive types of FORTRAN variables:

- INTEGER
- REAL
- DOUBLE
- LOGICAL

These variables take on values equivalent to their Constant counterparts described above. No data type currently exists for character variables in FORTRAN. While provisions are being made in the next version of FORTRAN[4], character variables are not in the current industry standard.

We will continue to take special note of variables whose values do not change when a program executes. They are thus considered to be constants as far as the program is concerned. Examples of such variables (e.g., TTY, KEY) can be found in FORTRAN programs of past articles. We allow these values to be defined in a variable because the value of the variable may need changing before the program is run on a *different* microcomputer. Since the value may change, we use a variable instead of a constant.

STRUCTURE OF CONCEPTS

Within the context of a computer program, structure provides organization to *both* the algorithm and the data. The organization of data is usually termed "data structuring." The organizing of program statements has adopted the name of "structured programming." As stated before, this organizing must be done with a purpose in mind. In fact, some have stated that the best programs are ones in which the structure of the data and the structure of the algorithm are very similar to each other.[5] Thus our choice of representation is important to building good programs.

Choice of Representation

The choice of representation is defined by the final structure of the data and algorithm. Ideally, we want a computer language capable of representing structures of data and algorithms needed to solve all problems. However, pragmatically that is not possible. Traditionally, computer languages were developed to address only a certain class of problem, and FORTRAN is no exception (classes of problems are explained in Chapter Two.)

FORTRAN was developed to solve scientific problems back in the late 1950s. The language has undergone little change, especially in the areas of algorithm structures and data structures, since the mid 1960s.[6] Because FORTRAN lacks richness in structure, we must do extra work to give our programs and data more organization. Chapters three and four of this series have already addressed the area of Structured programming constructs for FORTRAN. We will now

define the primitive data structures FORTRAN gives us, and will use them to build more complex structures.

Primitive FORTRAN Structures

The only two primitive structures allowed by FORTRAN are scalars and arrays. We should look at each separately:

Scalars

A scalar represents a single piece of data. Thus both constants and variables can have a scalar structure. Scalars can only hold one value at a time. In the case of constants, that value never changes. Variables, on the other hand, can hold many single values over the course of time, but can only hold a single value at any particular point in time. Scalars are very important because they are the basic building block (sometimes called "atoms" or "elements") of all other structures: ". . .entire hierarchies of structures may be built up, but obviously, the ultimate components of a structure must be atomic."[7]

Arrays

FORTRAN arrays are defined to be a collection of many scalars each having the *same* type. The array rules for FORTRAN permit only scalar variables in an array. There is no such thing as an array of constants.

Simply saying "a collection of scalar variables" is still insufficient, however, for "collections" is too broad a term. Certainly we can think of very elaborate ways of combining scalars into a structure. FORTRAN only permits the simplest of organizations: one, two, and three-dimensional arrays (Figure 4).

1-D Arrays

A one-dimensional array is composed of a collection of scalars put back to back (Figure 4). This collection thus forms a *row* of scalars. It was given the name one-dimensional because it is like a piece of string — having only length.

2-D Arrays

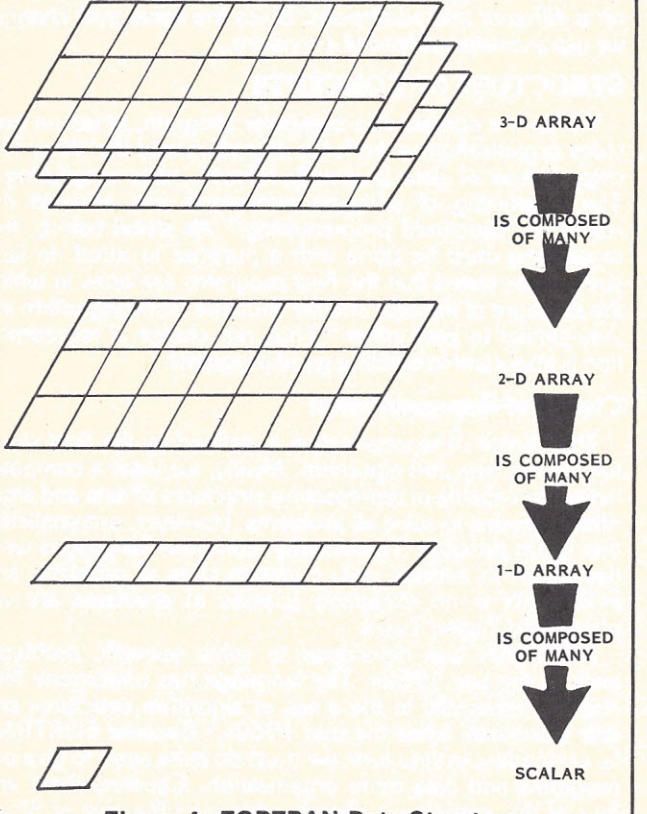


Figure 4. FORTRAN Data Structures

Taking several one-dimensional arrays of the same length, and laying them side by side will create a two-dimensional array (Figure 4). The resulting structure is a plane of scalar variables. Thus, it is like a piece of paper — having length and width.

3-D Arrays

The most complex FORTRAN data structure, a three-dimensional array, can be thought of as several two-dimensional arrays of the same size placed one on top of each other (Figure 4). The resulting shape is similar to a box of scalars. Thus a three-dimensional array has length, width and height.

The Subscript Concept

Even though FORTRAN arrays have various dimensions, there is a common way of accessing a single scalar within an array. FORTRAN allows the programmer to access each scalar in an array in a random fashion. This accessing is done via a *subscript.* A subscript is a (restricted) parenthesized expression whose result is a single positive non-zero INTEGER value for *each* dimension in the array. Each dimension's subscript expression is separated by a comma from other subscript expressions. For example, the following are three arrays (of one, two and three dimensions) with valid subscripts:

```
ARRAY1(SCRIPT)
ARRAY2(SCRPT1,SCRPT2)
ARRAY3(SCRPT1,SCRPT2,SCRPT3)
```

Subscript Rules

The expressions allowed for defining a subscript's value in FORTRAN are very restrictive. Different rules apply when defining and when using arrays.

Defining Arrays

An array is defined with the usual REAL, INTEGER, LOGICAL, or DOUBLE PRECISION statements used to define scalar variables. This array definition is fixed at compile time and can never vary. We distinguish arrays from scalars by appending parenthesized subscript expressions after the variable name. The subscript expression for *each* dimension is a scalar integer constant representing the maximum range in that dimension. Thus the limits for a subscript in a dimension are defined to be 1 to the maximum defined value.

For example, the following three FORTRAN statements:

```
INTEGER CODES(10)
REAL DIST(2, 17)
LOGICAL BITS(5,5,5)
```

define three arrays. The array CODES is a one dimensional array capable of holding ten INTEGER values. The array DIST can hold REAL values in two rows of 17 values in each row (or a total of 2 times 17 or 34 scalars). The BITS array can hold 5 times 5 x 5 or 125 LOGICAL values. This array is organized as five planes, each plane containing five rows, and each row holding five values.

```
a
v
v+a
v-a
a*v
a*v+b
a*v-b

where: v is an unsigned scalar integer variable,
       a and b are positive unsigned integer
       constants.
```

Figure 5. Types of Allowable FORTRAN Subscript Expressions



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Using Arrays

The programmer is allowed to use slightly more complex expressions to determine a subscript's value when using an array. FORTRAN allows only seven types of expressions, however (see Figure 5). These rules are certainly more restrictive than most computer languages, and are hard to remember — even for professional programmers (see reference 8 for experimental evidence). We will stick with just the first four types for our tutorial series. Any other complex expression we will calculate in a separate statement.

Not only does FORTRAN restrict subscript expressions, but FORTRAN does not give us much help for checking boundary conditions at run-time. Thus we could index the 100th scalar in a one-dimensional array defined to have a length of only 50 without receiving an error message from the FORTRAN run-time logic. Some FORTRAN compilers would not check for this very simple programming mistake. To check your compiler, try the program given in Figure 6.

```
00100       INTEGER TTY
00200       INTEGER SCRIPT
00300       INTEGER ARRAY(50),FILLER(50)
00400   C
00500       DATA TTY/1/
00600   C
00700       DO 300 SCRIPT = 1 , 100
00800       WRITF(TTY,100) SCRIPT
00900 100   FORMAT(1H ,'SCRIPT=',I3)
01000       IF (SCRIPT GT 50) WRITE(TTY,200)
01100 200   FORMAT(1H ,'SHOULD NOW BE IN ERROR. . .')
01200       ARRAY(SCRIPT) = 1
01300 300   CONTINUE
01400   C
01500       STOP
01600       END
```

Figure 6. Program to Check for Subscript Overflow Error.

```
C
C  PRODUCT RECORD DEFINITION:
C
      INTEGER PCODE
      REAL    PPRICE
      INTEGER PINV
```

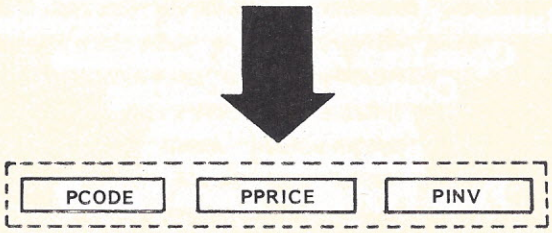


Figure 7. A Record Definition

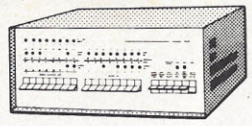
Advanced Structures

It has been a historical fact that computer languages are used in applications areas which strain the language's ability to easily represent a problem solution. FORTRAN was (and is) certainly one of those misused languages — sometimes by mistake, sometimes by necessity. Like it or not, FORTRAN has been, and will continue to be, used to implement business information systems. Fortunately, we can use the experience of others[9] to build the complex data structures (from FORTRAN scalars and arrays) needed to implement business applications. These complex data structures are built using another primitive data type — the record.

The Record Primitive

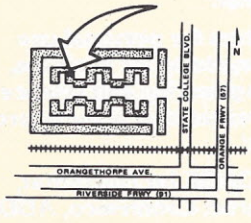
We will define a record to be a collection of *scalars* of *different* types. Records usually describe a few relevant charac-

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teristics of a particular subject matter. For example, a record can be composed of: a product's code, price, and amount in inventory. We can define a single record of this information in FORTRAN (Figure 7). We can also define a whole collection of similar records in FORTRAN by defining arrays for each data element of the record (Figure 8). A record would then be made up of data elements having the same subscript value in each array (Figure 9).

```
C
C       DEFINITION FOR 50
C       PRODUCT RECORDS:
C
        INTEGER    PCODE(50)
        REAL       PPRICE(50)
        INTEGER    PINV(50)
```

Figure 8. Defining Many Records

In the more general case[10] a record can actually be composed of other records, arrays, or scalars. We will, however, restrict our primitive record structures to just scalars for this tutorial.

The Linked List Concept

Having defined the record structure primitive, we can proceed to build more complex data structures. These structures are generally called linked lists, because they are composed of many records, each record is connected to other records via links (e.g., pointers). How we actually define, build, and use linked lists in FORTRAN will be discussed next month.

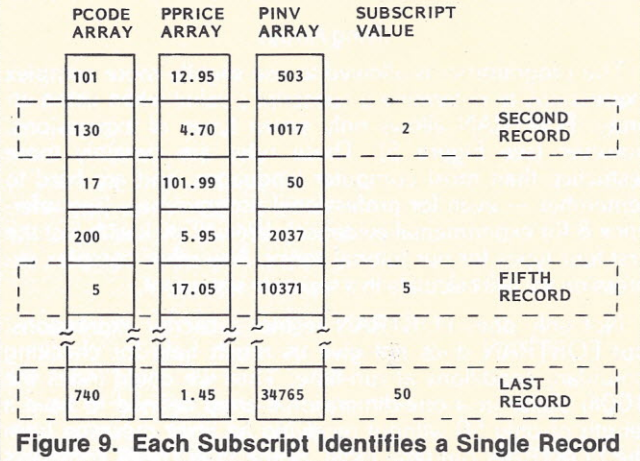


Figure 9. Each Subscript Identifies a Single Record

ALGORITHM CONCEPTS AND SPECIFICS

Within the context of computer programs for business applications, an algorithm's main purpose is to manipulate data. An algorithm reads in, writes out, and performs calculations upon data. From a business viewpoint, an algorithm takes in "raw" data and transforms it into useful information which helps the business to operate. As stated earlier, an algorithm has structure. The basic structural components of an algorithm are defined as sequence, decision and iteration.

Even though algorithms can be very complex due to the business rules which must be followed, three general operations are usually done to data structures: building, searching, and sorting. We will not take a look at those operations on FORTRAN arrays (operations on linked lists will be covered in Chapter Six). Before we look at each operation, however, we should be aware of a very important concept that can be applied to all operations on data structures.

The Alias-Alibi Concept

The concept of Alias-Alibi involves the way data structures are manipulated. One can perform an Alias operation *or* an Alibi operation. An Alias operation is defined to be the changing of a reference (e.g., name or pointer) to a structure of data. An Alibi operation is the physical moving of the contents of a data structure to another location. Thus, Alias is name changing, while Alibi involves changing location (Figure 10).

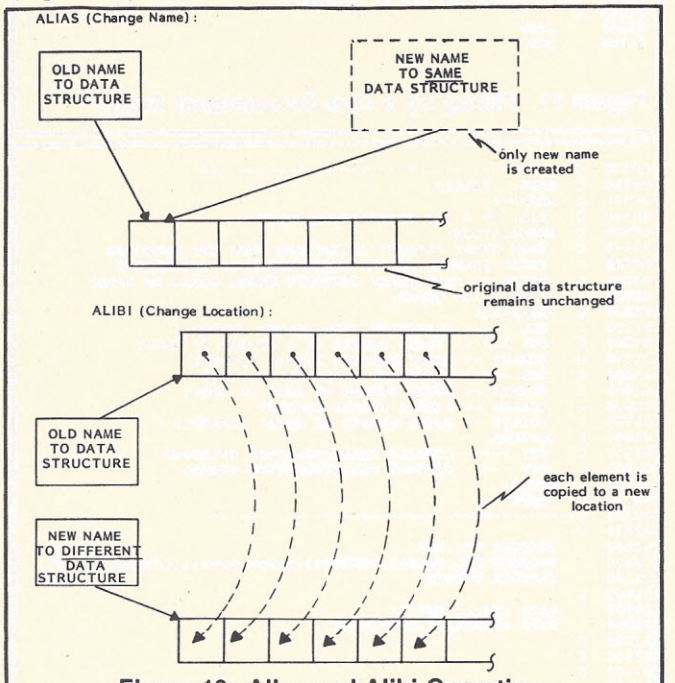


Figure 10. Alias and Alibi Operations

This concept is extremely important in the context of data structure manipulation because of the great differences in efficiency between the two methods. Clearly, changing the reference to a large 3-D array is much more efficient than copying that entire array to another location in memory. However, there are times when the information in a data structure *must* be copied. Thus, a data manipulation algorithm must make the most effective use of both the Alias and Alibi operations when it does its job.

Building Arrays

Before any useful work can be done on an array, it must be built and filled with data. Generally, the data is read in sequentially from some device and is then put into the appropriate position of the array. For most building operations, therefore, an Alibi operation (moving data from physical device into the array) is used.

```
00100  C-----------------------------------------
00200  C  NAME: FILL1D
00300  C  PURPOSE:
00400  C   FILL UP A ONE-DIMENSIONAL ARRAY
00500  C  DESCRIPTION:
00600  C   EACH ARRAY ELEMENT IS ENTERED FROM THE KEYBOARD
00700  C   ARRAY SUBSCRIPT IS INCREMENTED IN INCREASING
00800  C   ORDER SO THAT ARRAY CONTENTS MATCH ORDER OF ENTRY
00900  C  VARIABLES:
01000  C   NUMBER -- ARRAY HOLDING NUMBERS ENTERED
01100  C   SCALAR -- SINGLE NUMBER ENTERED
01200  C   SCRIPT -- SUBSCRIPT INTO ARRAY
01300  C   SIZE -- SIZE OF ARRAY
01400  C  DEVICES:
01500  C   KEY ----- CONSOLE TELETYPEWRITER KEYBOARD
01600  C   TTY ----- CONSOLE TELETYPEWRITER SCREEN
01700  C  NOTES:
01800  C   NONE
01900  C-----------------------------------------
02000  C
02100       INTEGER TTY,KEY
02200       INTEGER NUMBER(6),SCALAR,SCRIPT,SIZE
02300  C
02400       DATA TTY/1/,KEY/1/
02500       DATA SIZE/6/
02600  C
02700  C
02800  C
```


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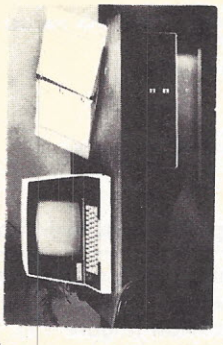
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```
02900      WRITE(TTY,100)
03000  100  FORMAT(1H ,'START OF PROGRAM')
03100  C
03200      WRITE(TTY,200) SIZE
03300  200  FORMAT(1H ,'YOU MUST ENTER A TOTAL OF ',I1,' NUMBERS...')
03400  C
03500      DO 500 SCRIPT = 1 , SIZE
03600      WRITE(TTY,300) SCRIPT
03700  300  FORMAT(1H,'ENTER ARRAY ELEMENT',I1,'-')
03800      READ(KEY,400) SCALAR
03900  400  FORMAT(I5)
04000      NUMBER(SCRIPT) = SCALAR
04100  500  CONTINUE
04200  C
04300      WRITE(TTY,9999)
04400  9999  FORMAT(1H,'END OF PROGRAM')
04500  C
04600      STOP
04700      END
```

Figure 11. Filling Up a One-Dimensional Array.

```
00100  C---------------------------------------
00200  C  NAME:  FILL2D
00300  C  PURPOSE:
00400  C   FILL UP A TWO-DIMENSIONAL ARRAY
00500  C  DESCRIPTION:
00600  C   EACH ARRAY ELEMENT IS ENTERED FROM THE KEYBOARD
00700  C   ARRAY SUBSCRIPTS ARE INCREMENTED IN INCREASING
00800  C   ORDER SO THAT ARRAY CONTENTS MATCH ORDER OF ENTRY
00900  C   (ROW MAJOR ORDER)
01000  C  VARIABLES:
01100  C   COL ----- SUBSCRIPT INTO COLUMN OF ARRAY
01200  C   COL SIZ -- TOTAL LENGTH OF A COLUMN IN ARRAY
01300  C   NUMBER -- ARRAY HOLDING NUMBER ENTERED
01400  C   ROW ----- SUBSCRIPT INTO ROW OF ARRAY
01500  C   ROWSIZ -- TOTAL NUMBER OF ROWS IN ARRAY
01600  C   SCALAR -- SINGLE NUMBER ENTERED
01700  C   TOTSIZ -- TOTAL NUMBER OF ARRAY ELEMENTS
01800  C  DEVICES:
01900  C   KEY ----- CONSOLE TELETYPEWRITER KEYBOARD
02000  C   TTY ----- CONSOLE TELETYPEWRITER SCREEN
02100  C  NOTES:
02200  C   NONE
02300  C---------------------------------------
02400  C
02500      INTEGER TTY,KEY
02600      INTEGER COL,COLSIZ,NUMBER(3,4)ROW,ROWSIZ,SCALAR,SCRIPT
02700      INTEGER TOTSIZ
02800  C
02900      DATA TTY/1/,KEY/1/
03000      DATA ROWSIZ/3/,COLSIZ/4/
03100  C
03200  C
03300  C
03400      WRITE(TTY,100)
03500  100 FORMAT(1H ,'START OF PROGRAM')
03600  C
03700      TOTSIZ = ROWSIZ * COLSIZ
03800      WRITE(TTY,200) TOTSIZ
03900  200  FORMAT(1H,'YOU MUST ENTER A TOTAL OF ',12,'NUMBERS...')
04000  C
04100      DO 600 ROW = 1 , ROWSIZ
04200      DO 500 COL = 1, COLSIZ
04300      WRITE (TTY,300) ROW,COL
04400  300  FORMAT(1H,'ENTER ELEMENT FOR ROW',I1,'COL',I1,'-')
04500      READ(KEY,400) SCALAR
04600  400  FORMAT(I5)
04700      NUMBER(ROW,COL) = SCALAR
04800  500  CONTINUE
04900  600  CONTINUE
05000  C
05100      WRITE(TTY,9999)
05200  9999  FORMAT(1H,'END OF PROGRAM')
05300  C
05400      STOP
05500      END
```

Figure 12. Filling Up Rows in a Two-Dimensional Array.

For one-dimensional arrays, one can simply increment a subscript from 1 to the last element of the array, filling in a scalar value at each position (Figure 11). Two-dimensional arrays require the programmer to keep track of both the row and column for each array element. Also, the programmer must decide whether a series of rows (Figure 12) or a series of columns (Figure 13) should be filled. Similarly, a three-dimensional array can be built by filling in the rows and columns for each plane.

```
00100  C---------------------------------------
00200  C  NAME:  FILL2C
00300  C  PURPOSE:
00400  C   FILL UP A TWO-DIMENSIONAL ARRAY
00500  C  DESCRIPTION:
00600  C   EACH ARRAY ELEMENT IS ENTERED FROM THE KEYBOARD
00700  C   ARRAY SUBSCRIPTS ARE INCREMENTED IN INCREASING
00800  C   ORDER SO THAT ARRAY CONTENTS MATCH ORDER OF ENTRY
00900  C   (COLUMN MAJOR ORDER)
01000  C  VARIABLES:
01100  C   COL ----- SUBSCRIPT INTO COLUMN OF ARRAY
01200  C   COL SIZ -- TOTAL LENGTH OF A COLUMN IN ARRAY
01300  C   NUMBER -- ARRAY HOLDING NUMBER ENTERED
01400  C   ROW ----- SUBSCRIPT INTO ROW OF ARRAY
01500  C   ROWSIZ -- TOTAL NUMBER OF ROWS IN ARRAY
01600  C   SCALAR -- SINGLE NUMBER ENTERED
01700  C   TOTSIZ -- TOTAL NUMBER OF ARRAY ELEMENTS
01800  C  DEVICES:
01900  C   KEY ----- CONSOLE TELETYPEWRITER KEYBOARD
02000  C   TTY ----- CONSOLE TELETYPEWRITER SCREEN
```

```
02100  C  NOTES:
02200  C    NONE
02300  C---------------------------------------
02400  C
02500       INTEGER TTY,KEY
02600       INTEGER COL,COLSIZ,NUMBER(3,4)ROW,ROWSIZ,SCALAR,SCRIPT
02700       INTEGER TOTSIZ
02800  C
02900       DATA TTY/1/,KEY/1/
03000       DATA ROWSIZ/3/,COLSIZ/4/
03100  C
03200  C
03300  C
03400       WRITE(TTY,100)
03500  100  FORMAT(1H ,'START OF PROGRAM')
03600  C
03700       TOTSIZ = ROWSIZ * COLSIZ
03800       WRITE(TTY,200) TOTSIZ
03900  200   FORMAT(1H,'YOU MUST ENTER A TOTAL OF ',12,'NUMBERS...')
04000  C
04100       DO 600 COL = 1 , COLSIZ
04200       DO 500 ROW = 1 , ROWSIZ
04300       WRITE (TTY,300) ROW,COL
04400  300   FORMAT(1H,'ENTER ELEMENT FOR ROW',I1,'COL',I1,'-')
04500       READ(KEY,400) SCALAR
04600  400   FORMAT(I5)
04700       NUMBER(ROW,COL) = SCALAR
04800  500   CONTINUE
04900  600   CONTINUE
05000  C
05100       WRITE(TTY,9999)
05200  9999   FORMAT(1H,'END OF PROGRAM')
05300  C
05400       STOP
05500       END
```

Figure 13. Filling Up Columns in a Two-Dimensional Array.

Searching Arrays

Once an array is built, various types of searches can be done in order to get a desired result. The array is built because its organization aids in getting that desired result: "We are concerned with the process of collecting information. . .and with the subsequent recovery of that information as quickly as possible."[11]

One of the more common types of information recovery involves the printing out of an array's contents. This is usually done by:

- Printing an entire row (if possible) on a single screen or printer line (Figure 14)

PROGRAM SEGMENT (all variables are declared as INTEGER):

```
          .
          .
          .
     WRITE(TTY,500) (NUMBER(SCRIPT), SCRIPT=1, SIZE)
500  FORMAT(1Hb,2014)
          .
          .
          .
```

POSSIBLE OUTPUT GENERATED:

```
17    12    7    29    51    88
```

Figure 14. Printing a Single Row (a 1-D Array)

PROGRAM SEGMENT (all variables are declared as INTEGER):

```
          .
          .
          .
     DO 600 ROW = 1, ROWSIZ
        WRITE(TTY,500) (NUMBER(ROW,COL), COL=1, COLSIZ)
500     FORMAT(1Hb,2014)
600  CONTINUE
          .
          .
          .
```

POSSIBLE OUTPUT GENERATED:

```
17    20    4    70
49    55    11    2
81    17    9    99
```

Figure 15. Printing Several Rows (a 2-D Array)

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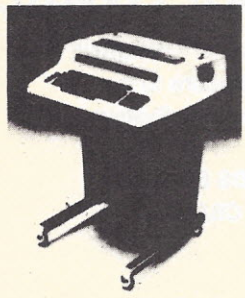
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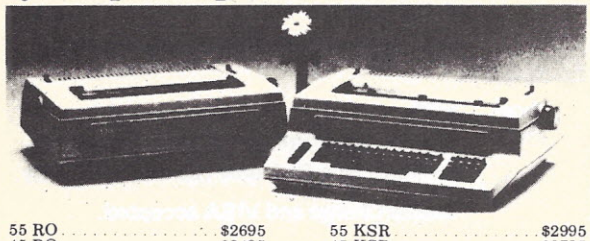
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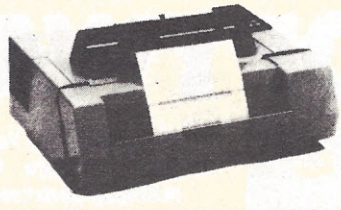
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CIRCLE INQUIRY NO. 102

PROGRAM SEGMENT (all variables are declared as INTEGER):

```
                .
                .
                .
      DO 800 PLANE=1, PLNSIZ
         WRITE(TTY,500)
500      FORMAT(1Hb)
         DO 700 ROW=1, ROWSIZ
            WRITE(TTY,600)(NUMBER(PLANE,ROW,COL), COL=1,COLSIZ)

600         FORMAT(1Hb,2014)
700      CONTINUE
800   CONTINUE
                .
                .
                .
```

POSSIBLE OUTPUT GENERATED FOR 2 PLANES:

```
 7   20   9   5
13    1  72  16
 5   17   3   4

19   20  73  64
93   31   5  27
41    9   3  39
```

Figure 16. Printing Several Planes (a 3-D Array)

- Printing each row on top of one another for 2-D arrays (Figure 15), and
- Separating each plane of a 3-D array by a few blank lines (Figure 16).

The FORTRAN syntax used to print an individual row of numbers is called an implied DO-loop. The array and its parenthesized subscript is specified first, and the loop control expression is then specified. This entire expression is surrounded by parentheses to distinguish it from other variables and implied DO-loops which may appear in the WRITE statement.

Another common searching function involves passing through all elements of an array and determining some result. An example of this is finding the minimum and maximum values within the array (Figure 17). Notice that MIN and MAX are set to the first element in the array (simply setting MIN and MAX to zero may not work in all cases). Notice, too, that most simple searches on numeric arrays involve Alibi operations (e.g., writing a number from an array to an output device, or moving an array element to MIN or MAX).

```
00100  C-----------------------------------------
00200  C  NAME:  MINMAX
00300  C  PURPOSE:
00400  C   FIND MIN AND MAX ELEMENTS IN AN ARRAY
00500  C  DESCRIPTION:
00600  C   EACH ARRAY ELEMENT IS ENTERED FROM THE KEYBOARD
00700  C   ARRAY SUBSCRIPTS ARE INCREMENTED IN INCREASING
00800  C   ORDER SO THAT ARRAY CONTENTS MATCH ORDER OF ENTRY
00900  C  (ROW MAJOR ORDER) EACH ELEMENT IS THEN REVIEWED
01000  C   FOR POTENTIAL OF BEING NEW MIN OR MAX VALUE
01100  C  VARIABLES:
01200  C   COL ----- SUBSCRIPT INTO COLUMN OF ARRAY
01300  C   COLSIZ -- TOTAL LENGTH OF A COLUMN IN ARRAY
01400  C   MAX ----- CURRENT MAXIMUM ELEMENT IN ARRAY
01500  C   MIN ----- CURRENT MINIMUM ELEMENT IN ARRAY
01600  C   NUMBER -- ARRAY HOLDING NUMBERS ENTERED
01700  C   ROW ----- SUBSCRIPT INTO ROW OF ARRAY
01800  C   ROWSIZ -- TOTAL NUMBER OF ROWS IN ARRAY
01900  C   SCALAR -- SINGLE NUMBER ENTERED
02000  C   TOTSIZ -- TOTAL NUMBER OF ARRAY ELEMENTS
02100  C  DEVICES:
02200  C   KEY ----- CONSOLE TELETYPEWRITER KEYBOARD
02300  C   TTY ----- CONSOLE TELETYPEWRITER SCREEN
02400  C  NOTES:
02500  C   NONE
02600  C-----------------------------------------
02700  C
02800       INTEGER TTY,KEY
02900       INTEGER COL,COLSIZ,NUMBER(3,4),ROW,ROWSIZ,SCALAR, SCRIPT
03000       INTEGER TOTSIZ,MIN,MAX
03100  C
03200       DATA TTY/1/,KEY/1/
03300       DATA ROWSIZ/3/,COLSIZ/4/
03400  C
03500  C
03600  C
03700       WRITE(TTY,100)
03800  100  FORMAT(1H,'START OF PROGRAM')
03900  C
04000  C  FILL UP ARRAY
```

```
04100  C
04200     TOTSIZ = ROWSIZ * COLSIZ
04300     WRITE(TTY,200) TOTSIZ
04400  200  FORMAT(1H,'YOU MUST ENTER A TOTAL OF ',12,'NUMBERS. . .')
04500  C
04600        DO 600 ROW = 1 , ROWSIZ
04700        DO 500 COL = 1 , COLSIZ
04800        WRITE(TTY,300) ROW,COL
04900  300  FORMAT(1H,'ENTER ELEMENT FOR ROW',I1,'COL',I1,'-')
05000        READ(KEY,400) SCALAR
05100  400       FORMAT (I5)
05200        NUMBER(ROW,COL) = SCALAR
05300  500       CONTINUE
05400  600       CONTINUE
05500  C
05600  C  FIND MIN AND MAX ELEMENTS
05700  C
05800        MIN = NUMBER(1,1)
05900        MAX = NUMBER (1,1)
06000  C
06100        DO 800 ROW = 1 , ROWSIZ
06200        DO 700 COL = 1 , COLSIZ
06300        IF (NUMBER(ROW,COL) .LT. MIN) MIN = NUMBER(ROW,COL)
06400        IF (NUMBER(ROW,COL) .GT. MAX) MAX = NUMBER(ROW,COL)
06500  700       CONTINUE
06600  800       CONTINUE
06700  C
06800        WRITE(TTY,900) MIN,MAX
06900  900  FORMAT(1H , 'MIN=',I5,'  MAX=',I5)
07000  C
07100        WRITE(TTY,9999)
07200  9999  FORMAT(1H ,'END OF PROGRAM')
07300  C
07400        STOP
07500        END
```

Figure 17. Finding Minimum and Maximum Values.

Sorting Arrays

There are many times when the contents of an array must be sorted. Sorting is nothing more than: ". . .the rearrangement of items into ascending or descending order."[12]

Even though the overall process is easy to understand, the various ways which this rearranging can be done are numerous. For this article, we will discuss two of the simplest sorting procedures — straight insertion sort, and bubble sort. These simple sorts are presented not only to introduce the sorting concept, but also because many business applications only require this simple sorting power.

Straight Insertion Sort

The straight insertion sort is the simplest method in the family of insertion sorts.[13] The insertion sort method continually keeps an array in sorted order as each new element is added (inserted) into the array. When the next element must be added to the sorted array, three steps take place:

- The insertion point in the array is found
- The elements beyond the insertion point are all moved down one position
- The new element is then placed in the now vacant array position.

This method actually sorts the array while the array is being built (Figure 18).

```
00100  C-----------------------------------------
00200  C  NAME: BUBBLE
00300  C  PURPOSE:
00400  C   SORT AN ARRAY USING THE BUBBLE SORT METHOD
00500  C  DESCRIPTION:
00600  C   EACH ARRAY ELEMENT IS ENTERED FROM THE KEYBOARD
00700  C   ARRAY SUBSCRIPT IS INCREMENTED IN INCREASING
00800  C   ORDER SO THAT ARRAY CONTENTS MATCH ORDER OF ENTRY
00900  C   ARRAY IS THEN SORTED BY SWAPPING PAIRS OF
01000  C   NUMBERS OUT OF SEQUENCE
01100  C  VARIABLES:
01200  C   ELEMNT -- SUBSCRIPT FOR AN ELEMENT DURING A PASS
01300  C   NUMBER -- ARRAY HOLDING NUMBERS ENTERED
01400  C   PASS ---- CURRENT PASS IN BUBBLE SORT
01500  C   SAVE ---- SAVED VALUE OF AN ELEMENT (FOR SWAPPING)
01600  C   SCALAR -- SINGLE NUMBER ENTERED
01700  C   SCRIPT -- SUBSCRIPT INTO ARRAY
01800  C   SIZE ---- SIZE OF ARRAY
01900  C  DEVICES:
02000  C   KEY ----- CONSOLE TELETYPEWRITER KEYBOARD
02100  C   TTY ----- CONSOLE TELETYPEWRITER SCREEN
02200  C  NOTES:
02300  C   NONE
02400  C-----------------------------------------
02500  C
02600     INTEGER TTY,KEY
```


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```
02700      INTEGER NUMBER(6),SCALAR,SCRIPT, SIZE
02800      INTEGER ELEMNT,PASS, SAVE
02900  C
03000      DATA TTY/1/,KEY/1/
03100      DATA SIZE/6/
03200  C
03300  C
03400  C
03500      WRITE(TTY,100)
03600  100  FORMAT(1H,'START OF PROGRAM')
03700  C
03800  C  FILL UP ARRAY
03900  C
04000      WRITE(TTY,200) SIZE
04100  200  FORMAT(1H,'YOU MUST ENTER A TOTAL OF',I1,'NUMBERS . . .')
04200  C
04300      DO 500 SCRIPT = 1 , SIZE
04400      WRITE (TTY,300) SCRIPT
04500  300  FORMAT(1H,'ENTER ARRAY ELEMENT',I1,'-')
04600      READ(KEY,400) SCALAR
04700  400  FORMAT(I5)
04800      NUMBER(SCRIPT) = SCALAR
04900  500  CONTINUE
05000  C
05100  C  SORT ARRAY
05200  C
05300      DO 800 PASS = 1 , SIZE
05400      DO 700 ELEMNT = 1, PASS
05500      IF (NUMBER(PASS) GE NUMBER(ELEMNT)) GOTO 600
05600      SAVE = NUMBER(PASS)
05700      NUMBER(PASS) = NUMBER(ELEMNT)
05800      NUMBER(ELEMNT) = SAVE
05900  600      CONTINUE
06000  700      CONTINUE
06100  800      CONTINUE
06200  C
06300  C  WRITE OUT SORTED ARRAY
06400  C
06500      WRITE(TTY,900)
06600  900  FORMAT(1H,'ARRAY IN SORTED ORDER . . .')
06700      WRITE(TTY,1000) (NUMBER(SCRIPT),SCRIPT=1,SIZE)
06800  1000 FORMAT(1H ,2016)
06900  C
07000      WRITE(TTY,9999)
07100  9999 FORMAT(1H,'END OF PROGRAM')
07200  C
07300      STOP
07400      END
```

Figure 18. Straight Insertion Sort.

Bubble Sort

The bubble (exchange selection) sort is the simplest method in the family of exchange sorts. The bubble sort takes a full array and exchanges pairs of elements that are out of order until all pairs are in order (Figure 19). This sort is given its name because elements with large values "bubble up" to their proper positions in the array.

```
00100  C-----------------------------------------
00200  C  NAME:  INSERT
00300  C  PURPOSE:
00400  C   SORT AN ARRAY USING THE SORT BY INSERTION METHOD
00500  C  DESCRIPTION:
00600  C   EACH ARRAY ELEMENT IS ENTERED FROM THE KEYBOARD
00700  C   EACH TIME A NEW ELEMENT IS ENTERED, THE CORRECT
00800  C   INSERT POINT IS FOUND IN THE EXISTING ARRAY
00900  C   THEN, ALL ELEMENTS TO THE RIGHT OF THE INSERT
01000  C   POINT ARE MOVED ONE POSITION TO THE RIGHT
01100  C   THE NEW ELEMENT IS THEN PUT INTO THE NOW VACANT
01200  C   ARRAY POSITION
01300  C  VARIABLES:
01400  C   ELEMNT -- CURRENT ELEMNT BEING INSERTED
01500  C   END ----- CURRENT END OF SORTED ARRAY
01600  C   INSERT -- INSERT PRINT IN ARRAY
01700  C   NUMBER -- ARRAY TO BE SORTED
01800  C  POS ----- SUBSCRIPT USED TO SHIFT ARRAY CONTENTS
01900  C  SCALAR -- SINGLE NUMBER ENTERED
02000  C  SIZE ---- SIZE OF ARRAY
02100  C  DEVICES:
02200  C   KEY ----- CONSOLE TELETYPEWRITER KEYBOARD
02300  C   TTY ----- CONSOLE TELETYPEWRITER SCREEN
02400  C  NOTES:
02500  C   NONE
02600  C-----------------------------------------
02700  C
02800      INTEGER  TTY,KEY
02900      INTEGER ELEMNT,END,INSERT,NUMBER(6),POS,SCALAR,SIZE
03000  C
03100      DATA TTY/1/,KEY/1/
03200      DATA SIZE/6/
03300  C
03400  C
03500  C
03600      WRITE(TTY,100)
03700  100  FORMAT(1H,'START OF PROGRAM')
03800  C
03900      WRITE(TTY,200) SIZE
04000  200  FORMAT(1H,'YOU MUST ENTER A TOTAL OF ',I1,' NUMBERS
04100  C
04200  C  BUILD A SORTED ARRAY OF LENGTH ONE
04300  C
04400      WRITE(TTY,250)
04500  250  FORMAT(1H,'ENTER ARRAY ELEMNT 1-')
04600      READ(KEY,300) SCALAR
04700  300  FORMAT(I5)
04800      NUMBER (1) = SCALAR
04900      END = 1
```

```
05000  C
05100  C  GET & INSERT ALL OTHER ELEMENTS
05200  C
05300      DO 800 ELEMNT = 2, SIZE
05400      WRITE(TTY,350) ELEMNT
05500  350  FORMAT(1H,'ENTER ARRAY ELEMNT',I1,'-')
05600      READ(KEY,300) SCALAR
05700  C
05800  C  FIND INSERTION POINT
05900  C
06000      INSERT = 1
06100  400  IF (INSERT .GT. END) GOTO 500
06200      IF (SCALAR .LT. NUMBER(INSERT)) GOTO 500
06300      INSERT = INSERT + 1
06400      GOTO 400
06500  500  CONTINUE
06600  C
06700  C  MOVE DOWN ELEMENTS WORKING BACKWARDS
06800  C
06900      POS = END
07000  600  IF (POS .LT. INSERT) GOTO 700
07100      NUMBER(POS + 1) = NUMBER(POS)
07200      POS = POS - 1
07300      GOTO 600
07400  700  CONTINUE
07500  C
07600  C  INSERT THE NEW ELEMENT
07700  C
07800      NUMBER(INSERT) = SCALAR
07900      END = END + 1
08000  800  CONTINUE
08100  C
08200  C  WRITE OUT SORTED ARRAY
08300  C
08400      WRITE (TTY,900)
08500  900  FORMAT(1H,'ARRAY IN SORTED ORDER . . .')
08600      WRITE(TTY,1000) (NUMBER(POS),POS=1,SIZE)
08700  1000  FORMAT(1H ,2016)
08800  C
08900      WRITE(TTY,9999)
09000  9999  FORMAT(1H,'END OF PROGRAM')
09100  C
09200      STOP
09300      END
```

Figure 19. Bubble Sort.

SUMMARY

The major concepts presented in this article can now be used to create more complex (yet still essential) data structures and algorithms commonly used in business applications. We will cover those topics in the next chapter and we will discuss more on the alias/alibi concept.□

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CROMEMCO is the company that offers total systems from one source. Rated number one in reliability, too. You can be sure that informed buyers choose only CROMEMCO. Floppy disk based systems using high-density technology and even Multi-Megabyte hard disk systems. CROMEMCO is the one that delivers the most powerful systems for the lowest cost. They offer software like word processing, data base management, or choose from a wide selection of their higher-level languages like 32K Structured BASIC, RATFOR, COBOL, FORTRAN, Z-80 Assembler - and even a Multi-User BASIC for applications needing up to seven terminals.

Choose from three different systems

- **Z2-H COMPUTER HARD DISK**
- **SYSTEM THREE COMPUTER 8" DUAL FLOPPY**
- **SYSTEM TWO COMPUTER 5" DUAL FLOPPY**

Take your choice of peripherals:

- **HIGH-SPEED MATRIX PRINTER**
- **LETTER-QUALITY PRINTER**
- **LOW-COST PRINTER**
- **DELUXE CRT - VERY INTELLIGENT!**

When selecting a computer system, make sure you get the best - get CROMEMCO. Whether your application is:

** Business ** Education ** Industry ** Sophisticated personal use

When you purchase a CROMEMCO System you become a member of the most select group of computer owners - CROMEMCO SYSTEM Owners.

The best place to purchase your CROMEMCO Computer System is from Sunshine Computer, Inc. Whether you are in Southern California or like to purchase your computer products by mail, we offer total system support, starting at the time you select your own CROMEMCO System from us. Our support just begins at purchase time and extends to complete warranty and maintenance plans by our factory-trained technicians. Become a satisfied CROMEMCO System owner of ours, like many businesses, major corporations, government offices, well-known universities and colleges, and individuals have done.

Sunshine Computer Inc.

20710 South Leapwood Ave. • Carson, California 90746 (213) 515-1736

Boards and more Boards!

CPU BOARDS *(assembled unless noted)*

CROMEMCO 4 MHz (ZPU-W), List $395 335
4 MHz (SCC-W), List $450 382
VECTOR GRAPHIC Z-80, List $247 . $210
INTERSYSTEMS (formerly Ithaca Audio)
NEW Series II Z-80, 4 MHz, List $395 $349
SSM CB1A 8080 CPU Board, List $219 $186
CB1A Kit, List $159 135
SSM CB2 Z-80 CPU, List $275 $234
CB2 Kit, List $210 179
DELTA Z-80, with I/O $239
SD SBC-100, List $350 $298
SBC-100 Kit, List $295 250
SBC-200, List $400 332
SBC-200 Kit, List $320 272

MEMORY BOARDS

MEASUREMENT SYSTEMS & CONTROLS
Guaranteed performance, incl. labor/parts 1 yr
DM6400 64K Board w/all 64K, $795 . $659
DM4800 with 48K, List $695 589
DM3200 with 32K, List $595 509
DM1600 with 16K, List $495 429
DM0000 with no RAM, $395 349
THE DMB SERIES –
DMB6400 64K Board w/all 64K . . . $859
DMB4800 with 48K 789
DMB3200 with 32K 709
MORROW SuperRAM – all static, all A&T
16K, 4 MHz or 2 MHz, List $349 . . $299
32K, 4 MHz, List $699 629
16K Memory Master, List $399 339
24K Memory Master, List $549 465
INTERSYSTEMS (formerly Ithaca Audio)
8K Static 2 MHz, A&T, List $165 . . $149
16K Static 4 MHz, A&T, List $495 . . 445
64K Dynamic, List $995 895
CALIFORNIA COMPUTER
16K Static, A&T, List $349.95 $259

FLOPPY DISK CONTROLLER BOARDS

MORROW Disk Jockey 1, A&T ($213) . $189
Disk Jockey 2D, A&T, List $479 429
SD Versafloppy 1, Kit, List $250 . . . $212
Versafloppy II, DD Kit, List $430 . . . 360
Versafloppy II, DD, A&T, List $350 . . 278
DELTA double density A&T ($385) . . $345
CONDUCTOR, double density A&T . . $269
INTERSYSTEMS FDC-2, A&T, ... $439
MICROMATION Doubler, DD, A&T . $399
TARBELL Floppy Disk Interface, Kit . $199
double density, Kit, List $325 295
double density, A&T, List $425 380

VIDEO BOARDS

I/O Mapped –
SD COMPUTER VDB-8024 Kit $370 . $299
Assembled, List $470 $399
XITEX SCT-100K, Kit . . . ONLY $154.95
SCT-100A Assembled $174.95
SSM VB2 Kit, List $169 $144
Assembled & Tested, List $234 $199

Memory Mapped –
VECTOR GRAPHICS Flashwriter®
FW2 u/lc 80-char. line, A&T, $368 . . $313
SSM VB1B 16x64, Kit, List $155 . . . $132
Assembled & Tested, List $210 $178
SSM VB3 4MHz, Kit, List $399 $339
4 MHz, A&T, List $464 $394

SHIPPING AND INSURANCE: Add $2.

All prices subject to change and all offers subject to withdrawal without notice.

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CIRCLE INQUIRY NO. 111

NEW PRODUCTS

Disk Memory System

A double sided, DEC-compatible flexible disk memory system — compatible with all DEC and IBM diskette formats — is available from Data Systems Design.

The DSD 480 system reads and writes on both sides of industry-standard 8-inch diskettes for a formatted capacity of one megabyte per diskette, or two megabytes of on-line storage.

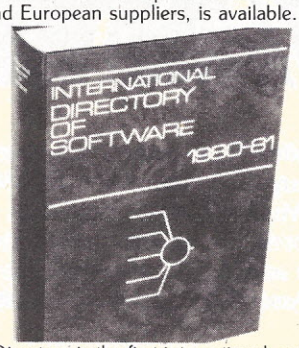
The system, which is hardware-, software- and media-compatible with DEC LSI-11 and PDP-11 computers, doubles the capacity of other DEC-compatible flexible disk systems. It also allows DSD 480 users to conveniently transfer data and programs between DEC and IBM computers. It is possible to transfer programs written for IBM machines directly to DEC computers, or vice versa.

For details contact Data Systems Design, Inc., 3130 Coronado Dr., Santa Clara, CA 95051, (408) 249-9353, Cynthia Guerra, Publications Coordinator.

CIRCLE INQUIRY NO. 151

International Directory of Software

The International Directory of Software, a one-volume directory featuring over 3200 independently-marketed software products available from U.S. and European suppliers, is available.



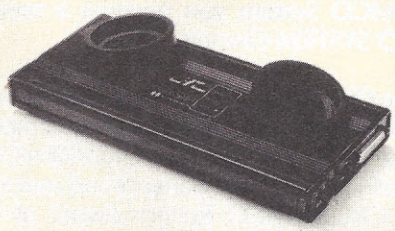
The Directory is the first international, comprehensive single-volume compendium of independent software products. Each product is indexed within as many as five categories, including one primary, two secondary, and two industrial categories, with details of hardware compatibility included in each index.

For more information contact CUYB Publications Inc., 633 Third Ave., New York, NY 10017, (212) 867-8833.

CIRCLE INQUIRY NO. 152

CAT™ Modem Price Reduced

Novation, a producer of modems for the personal and small computer market, has reduced the suggested retail price of its CAT modem to $189. The unit was previously priced at $199.



The 300 baud answer/originate EIA RS232C modem is engineered to transmit data over all telephone lines. The unit is Bell 103 compatible and has an AC wall-mount transformer.

For details contact Novation, 18664 Oxnard St., Tarzana, CA 91356.

CIRCLE INQUIRY NO. 154

Better Technical Presentations Guide

A "how-to" guide to making better technical presentations has just been published by the Visual Products Division of 3M.

Designed specifically for engineers, scientists, economists, computer specialists and other technical managers, the 12-page illustrated booklet contains instructions and recommendations which are practical, insightful and targeted directly to specific technical presentation needs.

Meeting essentials, such as an orderly agenda, selection of meeting room and visual aids are reviewed. Presentation techniques designed to insure meeting productivity are outlined.

Typical hints offered are: "bring management up to speed"; "avoid in-group words and phrases"; "consider need to know," and "keep it simple."

For a free copy of "How to Make a Better Technical Presentation" contact 3M, Dept. GP9-16, Box 33600, St. Paul, MN 55133.

CIRCLE INQUIRY NO. 153

Serial Interface Card for Apple

California Computer Systems model 7710A Asynchronous Serial Interface plug-in card enables the Apple II to communicate with all RS-232-C standard serial devices. The 7710A implements a full range of features desirable to the professional designer or serious hobbyist, and is fully compatible with Apple Pascal.

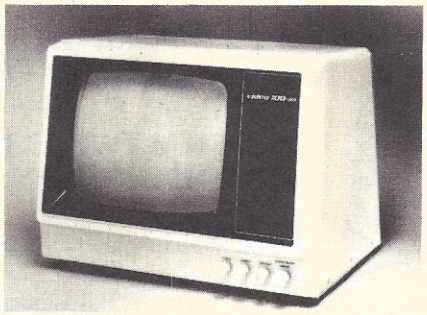
Features include fully selectable baud rates from 50-19,200 baud, 8- and 9-bit transmission, optional odd, even, or no parity, software programmable interrupts, double buffered data I/O, full handshaking, and power-down ROM.

For details contact California Computer Systems, Marketing Dept., 250 Caribbean, Sunnyvale, CA 94086, (415) 734-5811.

CIRCLE INQUIRY NO. 155

Black and White Monitor

Leedex Corporation has announced a 12" black and white monitor, the Video 100-80. Styled and built for industrial use, the Video 100-80 includes a rugged metal cabinet and is priced for both OEM and home applications.



The removable face plate provides mounting space for a mini floppy disk. There is also space inside the cabinet for an 11" x 14" PC board for custom designed controller electronics.

For details contact Leedex Corp., 2300 E. Higgins Rd., Elk Grove Village, IL 60007.

CIRCLE INQUIRY NO. 156

Data Management System

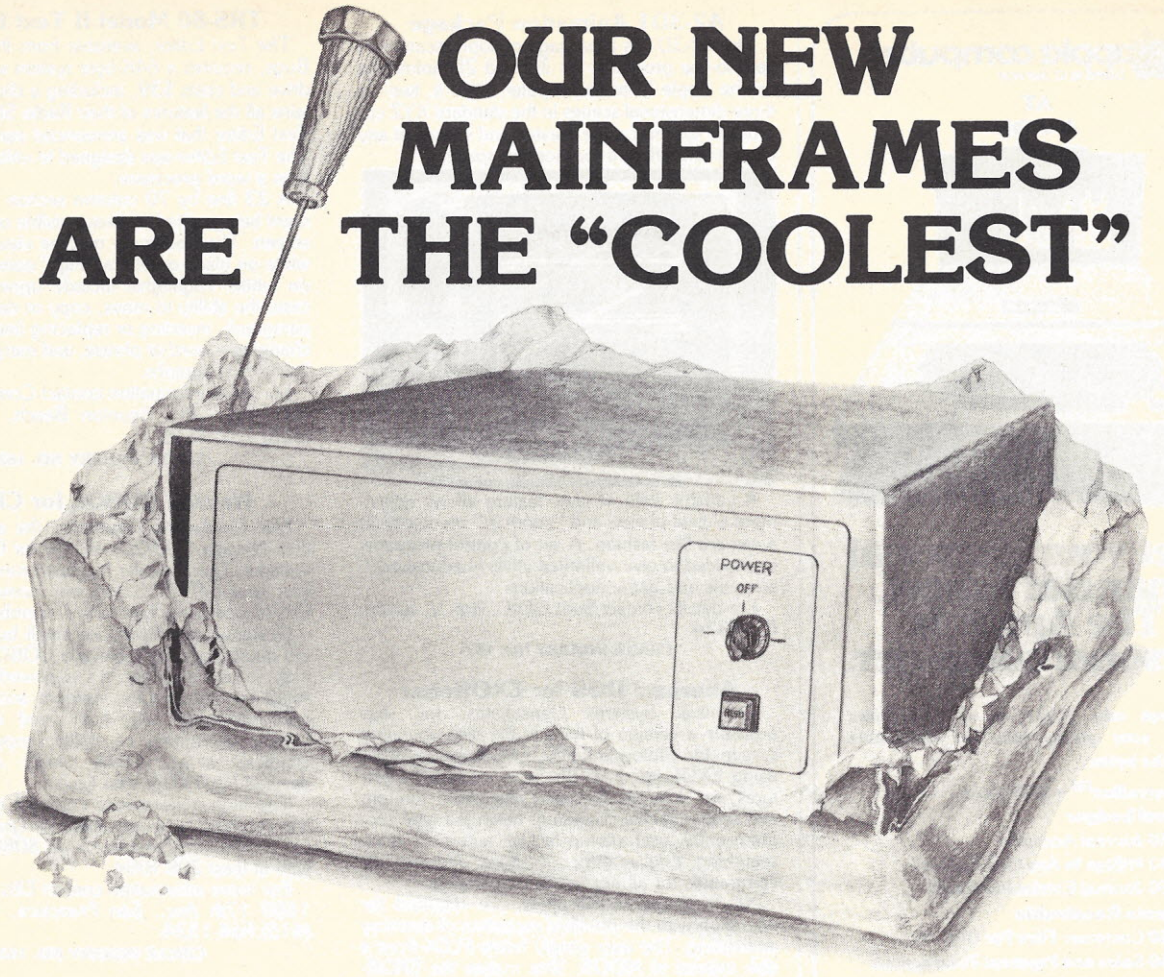
The Micro Data Management System for Micropolis BASIC 4.0 allows nonprogrammers to create and maintain database files. It features sorting on any key or combination of keys, report generation, record editing, and a foolproof backup routine.

MDMS allows the user to define files, records and access methods. The data record length — independent of the disk record length — may be any length up to 1,000 bytes.

For details contact GMS Consultants, P.O. Box 2685, Baltimore, MD 21215.

CIRCLE INQUIRY NO. 158

OUR NEW MAINFRAMES ARE THE "COOLEST"



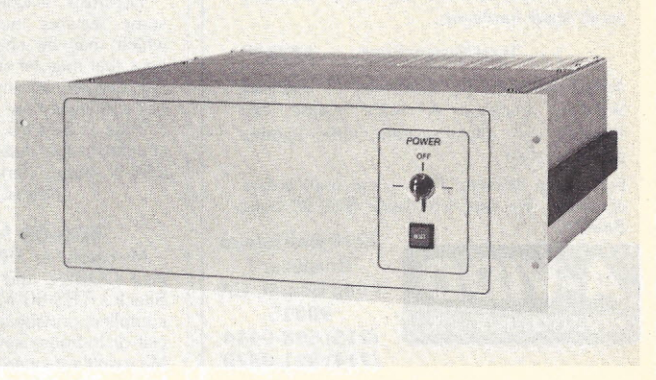
The new Model 2018 Microcomputer Mainframe System is really "Cool". The unique funnel design centers the muffin fan so that it exhausts the hot air at the rear of the chassis while drawing cool air through side ducts to the front of the cabinet. The air passes evenly over all of the PC cards set vertically allowing maximum cooling efficiency in the motherboard compartment under any load condition. Now, that's "Cool".

The Model 2018 system consists of an 18-slot, S-100 bus motherboard housed in a heavy duty precision formed cabinet that is convertible to either a desk top or rack mounted unit. A double bitted security key lock is standard on all models of the 2018 with a large power-on indicator light built into the reset switch. Now, that's "Cool".

For complete flexibility, a Constant Voltage Transformer (CVT) is provided with a selection of input voltages of 120 or 230 VAC at 50 or 60 CPS. Secondary voltages, which are fully fused, are rated at +8 VDC at 20 amps and +/−16 VDC at 3.5 amps. Now, that's "Cool".

To make your system really "Cool"... put our new Z80/64 CPU/memory card and our TWO-X double density disk controller in the 2018.

So if you are ready to stand above the crowd, call the "Coolest" distributors in the country, CMC MARKETING, or see it at your local retail computer store.



CMC Marketing

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- 250 Journal Accounts
- $90 Million In Any One Account
- 750 Journal Entries Per Month

Accounts Receivable
- 250 Customer Files Per Diskette
- 750 Sales and Payment Transactions
- Aged Trial Balance

Accounts Payable
- 100 Vendors Per Diskettes
- 300 Invoices For Up To $1 Million Each
- Prints Checks Automatically

Apple Computer Business Package – Hardware

Apple II Plus Computer 48K
Dual Disk Drives
9" High Resolution Video Monitor
Anadex 96 Column Printer With Apple Interface
1 Year Additional Parts and Labor Warranty on all Apple hardware.

Total System Price **$4210⁰⁰**

Added Bonus: The Controller™ Business Software Package A $625⁰⁰ value: **No Charge** with above system. Offer Expires June 1st, 1980.

Immediate delivery. Phone and mail orders accepted. We ship worldwide (F.O.B. Long Beach).

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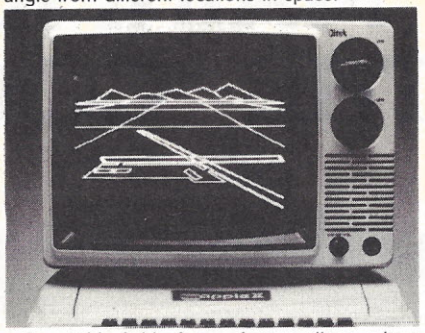
Hours: Mon - Thurs 8:30 AM-5:30 PM; Fri 8:30 AM-9:00 PM; Saturday 10:00 AM-5:30 PM

master charge VISA

CIRCLE INQUIRY NO. 95

A2-3D1 Animation Package

The A2-3D1 is a package of sophisticated yet easy-to-use programs for 3D and 2D animation on the Apple II microcomputer. With it, two- or three-dimensional scenes in the standard XYZ coordinate system can be created and viewed at any angle from different locations in space.



A variable field of view feature allows adjustment of field of view and "zoom in" on objects in a camera-like fashion. A set of control programs is provided to give unlimited utility in educational, scientific and game applications.

For details contact SubLOGIC, Box V, Savoy, IL 61874.

CIRCLE INQUIRY NO. 157

Alternate DOS for EXORciser

Technical Systems Consultants, Inc. has available a version of their FLEX disk operating system for Motorola 6800 EXORciser systems using EXORdisk II or III. Some of FLEX's features are dynamic filespace allocation, random and sequential file-accessing, batch job type program entry, user startup facility, automatic drive searching, English error messages, and over 20 commands for all normal disk operations.

No hardware modifications are required for operation with the possible exception of memory addressing. The user simply boots FLEX from a disk instead of MDOS. This makes the EXORciser compatible with most 6800 disk systems and allows it to run any FLEX based software.

For details contact Technical Systems Consultants, Inc., P.O. Box 2570, West Lafayette, IN 47906, (317) 463-2502.

CIRCLE INQUIRY NO. 159

Convert TRS-80 to Communicating Terminal

Percom Data Company has available a program which will allow a TRS-80 computer to be used as a full duplex ASCII terminal. The program, called TERM80™, loads a machine language program for terminal operation.

TERM80 is written in Level II BASIC, and some features include terminal characteristics which may be changed/checked at any time, keys that may be struck while characters are being received with no character loss and both upper and lower case operation with shift-lock key.

Price is $24.95 on minidiskette with user instructions. For details contact Percom Data Co., 211 N. Kirby, Garland, TX 75042.

CIRCLE INQUIRY NO. 160

TRS-80 Model II Software

Microsoft has TRSDOS-compatible versions of their COBOL and BASIC compilers for Radio Shack's TRS-80 Model II microcomputer. Both compilers provide complete facilities for commercial or in-house software development including Microsoft's standard macro assembler and linking loader. The relocatable object code produced by the compilers may be resold, transported to other Model-IIs, or built into turnkey systems.

The COBOL-80 compiler is an ANSI-74 implementation of COBOL, featuring interactive screen handling capability and an optional packed decimal format that reduces mass storage requirements. The BASIC compiler produces highly optimized object code that runs 3-10 times faster than interpreted BASIC programs.

For details contact Microsoft, 10800 N.E. 8th St., Suite 819, Bellevue, WA 98004, Paul Allen.

CIRCLE INQUIRY NO. 161

TRS-80 Model II Text Editor

The Text Editor, available from the Computer Bugs, requires a 64K-byte system with one disk drive and costs $39, including a diskette. It contains all the features of their Radio Shack Model I Text Editor that was announced earlier for $29. The Text Editor was designed to utilize the Model II as a word processor.

A 23 line by 70 column section of the document being edited is always visible on the display screen. The document may be viewed as either white on black or with a "Flip" command, black on white. Highlights include upper and lower case, the ability to move, copy or delete a line or paragraph, inserting or replacing lines, finding or changing a word or phrase, and merging multiple lines or paragraphs.

For more information contact Computer Bugs, P.O. Box 789, Boynton Beach, FL 33035, (305) 737-4738.

CIRCLE INQUIRY NO. 162

Nevada COBOL for CP/M

Ellis Computing announces the availability of their Nevada COBOL compiler for CP/M-based systems. The compiler has been running for one year under PTDOS and was converted to the CP/M operating system in December of 1979.

Designed specifically for small businesses using microprocessors, Nevada COBOL is simple, easy to use and fast. It's a powerful subset of ANSI-74 and includes random access file support; sequential files both fixed and variable length; debugging capability; copy statement; character string, 16-bit binary and packed decimal (COMP-3) data types.

The high performance compiler generates inline machine language object programs at a rate up to 650 lines/minute on an 8080/Z80-CPU with at least 20K RAM.

For more information contact Ellis Computing, 1480 17th Ave., San Francisco, CA 94122, (415) 664-1534.

CIRCLE INQUIRY NO. 163

Cartridge Tape Sub-system Increases Storage Capacity

The DRS-232 Sub-system from Alloy Engineering Company, Inc. links up to four D.E.I. DC-300 high density cartridge tape drives to an RS-232C port to increase storage capacity by up to 13.4 MB. The sub-system consists of an



interface, power supply, and optional table cabinet or 19" rack mount.

For details contact Alloy Engineering Co., Inc., 85 Speen St., Framingham, MA 01701, (617) 620-1710.

CIRCLE INQUIRY NO. 164

6800 Business Software

Applevalley Day School, Inc. is making available their business programs, written in SWTPC Disk BASIC, Version 3.0 for 5" floppy disk and the SWTPC 6800 computer. The programs are being offered for use by small service businesses, and can be changed to suit special requirements using the hints provided in the source listings.

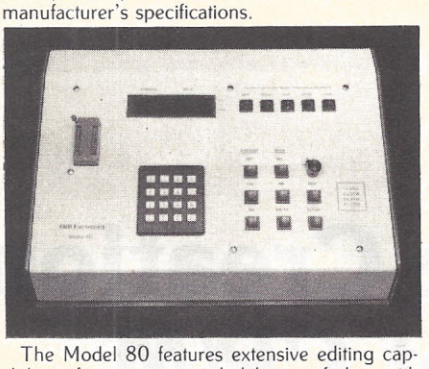
Other documentation provided includes instructions for adapting to the user's system, detail file descriptions, and a tutorial.

For details contact Applevalley Day School-Software, Richard Cagle, 11103 Sagepark Lane, Houston, TX 77089.

CIRCLE INQUIRY NO. 171

EPROM Programmer

The Model 80 EPROM Programmer from SMR Electronics, Inc. is an economical, self-contained programmer for single supply EPROMs. The Model 80 can program 2758, 2516, 2716, 2532 and 2732 EPROMs to manufacturer's specifications.



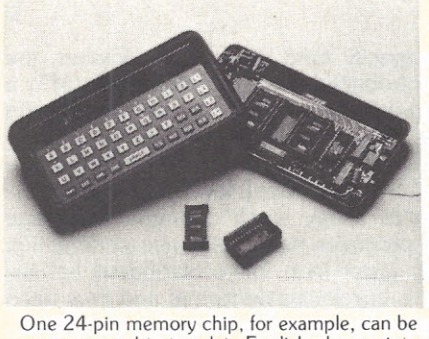
The Model 80 features extensive editing capabilities for insertion and deletion of data with resequencing prior to programming, and true hexadecimal display of addresses and data.

For details contact SMR Electronics, 3 Haven Rd., Medfield, MA 02052, Steve Rudnick.

CIRCLE INQUIRY NO. 165

Foreign Language Cartridge

The Molex holder and socket constitute a "foreign-language memory cartridge," which mates with a Mostek microprocessor and a 16-character alphanumeric display. The language cartridge helps to exchange languages by using the same basic program.



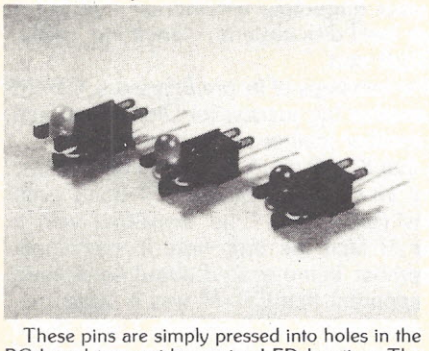
One 24-pin memory chip, for example, can be preprogrammed to translate English phrases into German and vice versa. Other chips can translate French, Russian and Italian.

For details contact Molex Inc., 2222 Wellington Cr., Lisle, IL 60532, (312) 969-4550, Al Maag or Don Siebold.

CIRCLE INQUIRY NO. 166

Subminiature LED Indicators

A subminiature Super-Brite LED indicator-light assembly is intended for circuit-board mounting. The IDI Series 5320/5321 incorporate LEDs that are at right-angles to the base mounting pins of the assembly.



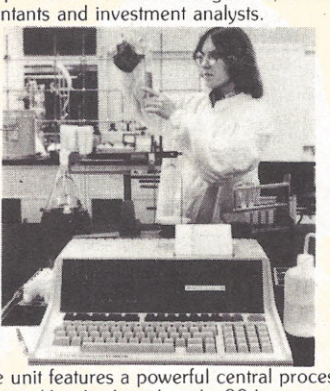
These pins are simply pressed into holes in the PC board to provide precise LED location. The mounting base includes a board standoff to prevent flux entrapment and permit easy cleaning.

For details contact Industrial Devices, Inc., 7 Hudson Ave., Edgewater, NJ 07020.

CIRCLE INQUIRY NO. 167

Personal Computing for Professionals

The HP-85 computer from Hewlett-Packard is designed for personal use in business and industry by professionals such as engineers, scientists, accountants and investment analysts.



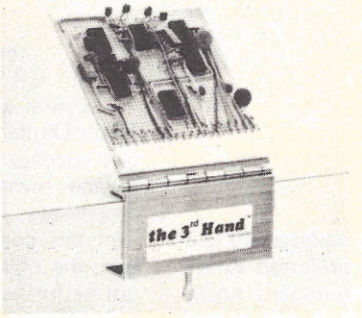
The unit features a powerful central processor, typewriter-like keyboard with 20-key numeric pad, high resolution CRT display, thermal printer, cartridge tape drive, enhanced BASIC language and interactive graphics in a fully integrated system the size of a portable electric typewriter.

For details contact Hewlett-Packard, 1507 Page Mill Rd., Palo Alto, CA 94304.

CIRCLE INQUIRY NO. 172

Circuit Board Holder

The new spring action model of "the 3rd Hand" circuit board holder requires no tightening of screws or arms to hold the circuit board. Boards are safely gripped when just inserted into the PVC gasket.



Clamped to the edge of the workbench it holds the board at a convenient angle to place parts and is then flipped forward to solder/wire-wrap parts in place. Open end design means no adjustment for various size boards.

For details contact Studio 3, P.O. Box 1184, Kailua, Hawaii 96734.

CIRCLE INQUIRY NO. 169

Multi-User/Multi-Tasking Computer

The Taurus T8000 computer system is based upon the Zilog Z8000 16-bit CPU. The series of computers supports up to 48 users, and hard disk capacity of up to 640 megabytes of storage using Winchester type disks.

The entry level system the T8000/2 comes standard with two double-sided/double density floppy disk drives and two serial ports. It is fully expandable and allows the addition of serial I/O ports and hard disk drives.

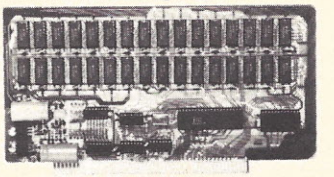
The mid-level system is the T8000/40 which comes standard with 8 serial I/O ports, a 40-megabyte hard disk, and a single double density/double sided floppy disk drive for backup. This model can also be expanded by adding additional serial I/O ports and hard disk drives.

The multi-user operation system TOS includes an Assembler, Text Editor, Utilities, and a BASIC language which contains a sort function and ISAM file handling.

For more information contact Taurus Research, Inc., 2880 S. Main St., Suite 220, Salt Lake City, UT 84115, (801) 485-1552.

CIRCLE INQUIRY NO. 170

The days of complicated, unreliable, dynamic RAM are gone:



INTRODUCING

JAWS

the ultrabyte memory board

$199.95 *(complete kit with 16K memory)*

Netronics consistently offers innovative products at unbeatable prices. And here we go again — with JAWS, the ultrabyte 64K S100 memory board.

ONE CHIP DOES IT ALL

JAWS solves the problems of dynamic RAM with a state-of-the-art chip from Intel that does it *all*. Intel's single chip 64K dynamic RAM controller eliminates high-current logic parts . . . delay lines . . . massive heat sinks . . . unreliable trick circuits.

REMARKABLE FEATURES OF JAWS

Look what JAWS offers you: Hidden refresh . . . fast performance . . . low power consumption . . . latched data outputs . . . 200 NS 4116 RAMs . . . on-board crystal . . . 8K bank selectable . . . fully socketed . . . solder mask on both sides of board . . . designed for 8080, 8085, and Z80 bus signals . . . works in Explorer, Sol, Horizon, as well as all other well-designed S100 computers.

GIVE YOUR COMPUTER A BIG BYTE OF MEMORY POWER WITH JAWS — SAVE UP TO $90 ON INTRODUCTORY LIMITED-OFFER SPECIAL PRICES!

UNDECIDED? *TRY A WIRED 16K JAWS IN YOUR COMPUTER ON OUR 10-DAY MONEY- BACK OFFER (SPECIFY YOUR COMPUTER).*

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NETRONICS RESEARCH & DEVELOPMENT LTD.

333 Litchfield Road, New Milford, CT 06776

Please send the items checked below:

- ☐ **JAWS 16K RAM kit,** No. 6416, $199.95.*
- ☐ **JAWS 16K RAM fully assembled, tested, burned in,** No. 6416W, $229.95.*
- ☐ **JAWS 32K RAM kit,** No. 6432, (reg. price $329.95), **SPECIAL PRICE $299.95.***
- ☐ **JAWS 32K RAM fully assembled, tested, burned in,** No. 6432W, (reg. price $369.95), **SPECIAL PRICE $339.95.***
- ☐ **JAWS 48K RAM kit,** No. 6448, (reg. price $459.95), **SPECIAL PRICE $399.95.***
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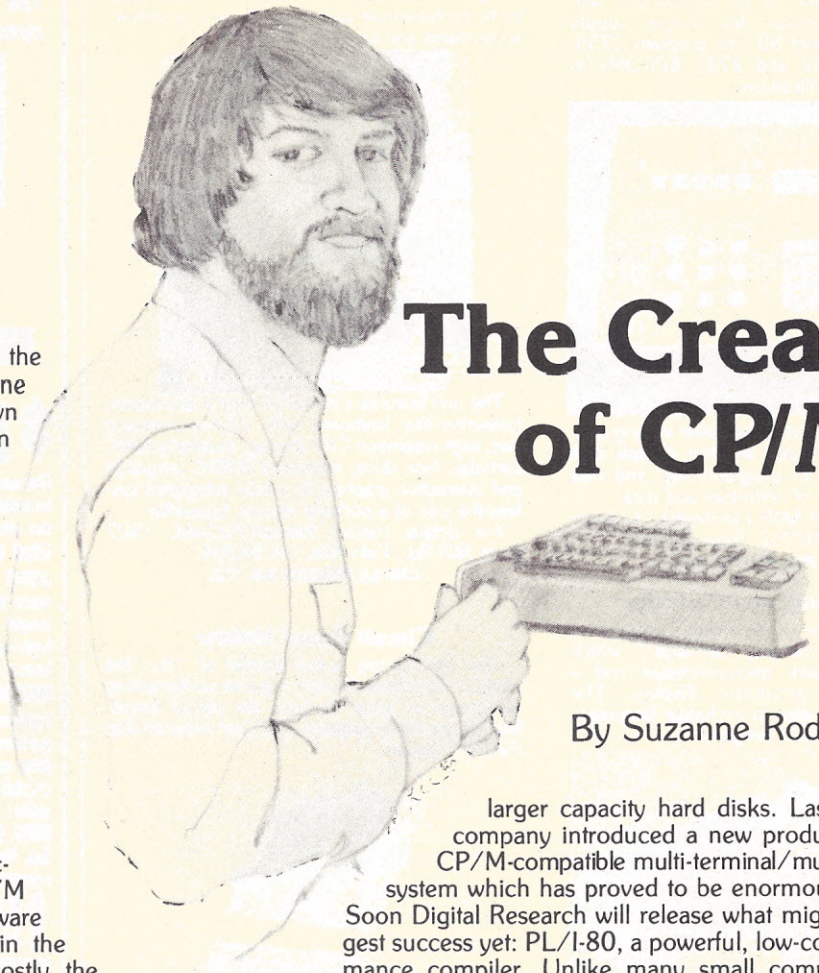
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CIRCLE INQUIRY NO. 114



The Creation of CP/M

By Suzanne Rodriguez

The sweetest success of all is the kind that comes unbidden. One day you're minding your own business, involved and happy in your work. The next day the world is touting your name.

That is what happened to Gary Kildall.

In the mid-70's, Kildall created what is perhaps the most widely-used microcomputer operating system in the world, CP/M*. In 1979, CP/M was the recipient of the prestigious Data Software Hero Award given annually by the Datapro Research Corporation to honor a software which has received an outstanding degree of user acceptance. This award to CP/M marks the first time a micro software has been so honored, since, in the past, the reward has been mostly the reserve of minis.

CP/M is not without its critics, despite its widespread use and popularity. One industry insider, who preferred to remain anonymous, stated, "The real professionals I know who have looked at it are unimpressed. It is not a real operating system in the strict sense of the word. It was something that caught on and grew; it's like the S-100 bus of software."

Steve Newberry, an independent consultant in the Silicon Valley area, scoffs at this criticism.

"When somebody says CP/M isn't a real operating system, he's assuming that an operating system behaves or should behave like some other operating system the speaker has in mind. CP/M is a single-user system, and it makes sense that it can't do some of the things that UNIX or the big time-sharing systems can do," Newberry explained, "the real point is that, historically, CP/M is what has taken micros from the realm of enthusiast/hobbyist/amateur into the realm of becoming a serious tool."

Kildall shared similar views as he said, "I see the way the industry has evolved as a matter of building up. First there were the primitives like the 4004, then the assemblers and simulators to help you get tools, then systems languages like C or PLUS, then operating systems, then applications languages, then the applications themselves — to the point where a guy can walk off the street and buy a computer that will really handle his inventory problem or his billing problem."

Kildall founded Digital Research in 1976 to support CP/M, develop new products and provide administrative functions. About a year ago, the company released CP/M 2.0, an enhanced version of CP/M which can manage larger capacity hard disks. Last October, the company introduced a new product, MP/M*, a CP/M-compatible multi-terminal/multiprogramming system which has proved to be enormously popular.

Soon Digital Research will release what might be their biggest success yet: PL/I-80, a powerful, low-cost, high-performance compiler. Unlike many small computer language processors, PL/I-80 produces native machine code which executes considerably faster than interpreter-based translation; the object code is in relocatable format and thus need not be further processed by assembly language translators.

According to Kildall, the PL/I-80 will serve many functions to benefit a wide range of users.

"Say a businessman owns a computer system and he has particular needs to satisfy 100 employees: How old are they? What are their addresses? Wages? How much do they sell per week, per month? Today it is not possible to buy an applications package off the shelf like that, because there just aren't programs to satisfy everybody's needs. But with PL/I-80 you can write a program in short order or hire somebody since there are literally hundreds of thousands of PL/I programmers around. An immense power of tools in language is right at your fingertips, whether you've got a TRS-80 or a multi-user hard disk system — anything, really, that uses CP/M," Kildall said.

If PL/I-80 follows the footsteps of its predecessors, CP/M and MP/M, it will be another big success for Digital Research and for Gary Kildall, another feather in the cap of fame.

The irony of it all is that Kildall never set out to be famous, especially from writing an operating system. "I don't even *like* operating systems very much," he explained with a chuckle, "as a matter of fact, the only time in my whole career that I can remember being scared about something was when it became apparent that CP/M was a huge success and everybody was buying it. Suddenly I saw that I could easily become a guy who would support and extend operating systems the rest of my life. I didn't want that, I didn't want to be stuck there."

Little chance of that. A brief glance at Kildall's "career pattern" shows no pattern whatsoever and, while this cannot be

*CP/M and MP/M are registered trademarks of Digital Research

recommended for everybody, and is sure to horrify recent MBA graduates, it's certainly worked well for him.

Born in Seattle, Kildall attended the University of Washington where he received a BA in Numerical Analysis and an MA — and later a PhD — in Computer Science. Joining the Navy during the Viet Nam War, Kildall was assigned to teach at the Naval Postgraduate School in Monterey, California where, because they were just starting a Computer Science Department (1969), he was able to influence and work on the curriculum. Eventually he joined the faculty of the school in a civilian capacity.

While Kildall worked at the Postgraduate School he also worked for Intel and a few of the other new industries like Signetics. He did some program designs, seminars, and wrote a compiler for systems languages called PLUS which is still owned, although not marketed, by Digital Research.

It was about this time, also, that Kildall wrote CP/M, a project which evolved slowly due to lack of money, lack of commercially available controllers, and Kildall's own lack of hardware design experience. Eventually, though, in the fall of 1974, CP/M was up and running for the first time, an experience which was recently documented by Kildall in a *Dr. Dobb's Journal* article:

> Our first compiler was a beautiful rat's nest of wire-wraps, boards and cables (well, at least it was beautiful to us!), which, by good fortune, often performed seeks, reads and writes just as requested. For agonizing minutes we loaded CP/M machine code through the paper tape reader into the Intellec-8 memory. To our amazement, the disk system went through its initialization and printed the CP/M prompt at the teletype. Anyone who has brought up CP/M on a homebuilt computer has felt this moment of elation. A myriad of connections are properly closed, bits are flying at lightning speeds over busses and through circuits and program logic, to provide a single prompt. In comparison to our paper devices, we had the power of an S/370 at our fingertips. A few nervous tests confirmed that all was working properly, so we retired for the evening to take on the simpler task of emptying a jug of not-so-good red wine while constructing battles and speculating about the future of our new software tool.

The future of the new software was to be one of success, although not an immediate success. The first commercial licensing of CP/M took place in 1975 with contracts between Digital Systems, Omron of America and Lawrence Livermore Labs where CP/M was used to monitor programs in the Octopus network. Eventually CP/M was offered for sale on the open market, where it was discovered by computer hobbyists.

"About three years ago I found that support of CP/M was taking most of my time, so I left the Naval Postgraduate School," Kildall said. "That's when we founded Digital Research."

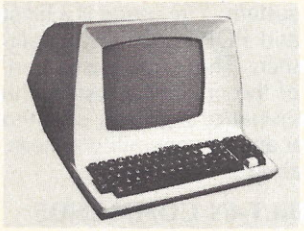
According to Kildall, Digital Research does not have any immediate plans for the future. "I can't really say what Digital's next big project will be. We might get into networking, get a little heavier into 8080 software. I don't know at this point," he said.

No matter what lies in the future for Kildall, if Digital Research continues to experience the same kind of response with CP/M and MP/M, this energetic company is well on their way to success.□

ABOUT THE AUTHOR

Suzanne Rodriguez is editor of Dr. Dobb's Journal of Computer Calesthenics and Orthodontia, a reference journal for small computer users.

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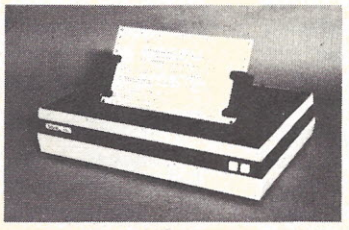


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CP/M Version 2.0
An 8080/Z-80 Operating System

Review by Alan R. Miller, Software Editor

CP/M* is available for almost all popular 8080/Z-80 computers and floppy disk systems. Version 1.4 was originally developed for use with up to four 8-inch soft-sectored floppy disks. After this version was adapted by Lifeboat Associates for use with the 5-inch floppy disks, CP/M became a nearly universal system.

NEW CONTROL CHARACTERS

While Version 1.4 contained many useful features, there were also a few problems. Since the system was designed before the video console became popular, error correction was hard-copy oriented. For example, the user deleted the most-recent console entry by pressing the DEL key. This removed the character from the console buffer. Unfortunately, the console then printed the incorrect character a second time, right next to the original, incorrect character. After the operator had made three or four such corrections, the input line became unreadable. When this happened, a Control-R could be typed to reprint the line in its corrected form.

One of the three new control characters of Version 2.0 corrects this deficiency. The ASCII backspace character, a Control-H, is used as an additional error-correction key. Each time a Control-H is typed during console input, the previously entered character is deleted from the input buffer, just as it is with the DEL command. But, in this case, the cursor on the video screen actually backs up, removing the erroneous character from the screen.

This correction operation does not necessarily perform a simple backup of the cursor. If the previous character is a tab, then the cursor backs up the correct number of spaces until it is positioned next to the second previous character.

Two additional control commands have been added: Control-X and Control-J. Typing a Control-X will delete the current line from the input buffer and move the cursor to the beginning of the present line. By comparison, the Control-U key also cancels the current line, but in this case the cursor moves to the next line. The third new control character is the line feed (Control-J). It performs the same function as the carriage return.

Digital Research missed a chance to improve the scroll command. Console output scrolling is frozen by typing a Control-S. It is resumed by typing any other character. Most other operating systems use the pair Control-S, Control-Q for this purpose. In the usual case, scrolling is frozen with a Control-S and resumed with a Control-Q. The problem is that scrolling in CP/M is aborted if any character other than Control-S is typed. Thus if scrolling is stopped with a Control-S, then resumed by typing any other character, then an extra touch can abort the task. Microsoft's CP/M BASIC incorporates the typical Control-S, Control-Q scroll control by isolating console input from the CP/M BDOS.

DIRECT CONSOLE INPUT AND OUTPUT

CP/M is a nearly universal operating system because it is easy to tailor general programs for it. All programs such as BASIC, Pascal, FORTRAN, etc., which operate under CP/M, have access to the I/O and disk routines of CP/M. This access is made through the BDOS (basic disk operating system) entry address which is stored at memory address six.

But it is sometimes desirable to isolate a program from the BDOS, console-input processor. As an example, consider the effect of a Control-C command. Whenever this command is processed by the CP/M BDOS, the current task will be terminated, and control will return to the CP/M operating system. If a user were editing a file located in memory, and inadvertently typed a Control-C, then the edit file would be lost. The same problem occurs with a BASIC interpreter. Here, the problem is complicated by the fact that a Control-C is the standard abort command for BASIC.

To avoid this problem, editor programs such as ED-80, EDIT-80, and Wordmaster, and the BASIC programs written by Microsoft, Tarbell, and Xitan isolate the console input from the CP/M BDOS. This operation has to be specifically programmed for Version 1.4. Version 2.0, however, has provisions for this technique.

There is a set of function numbers which are used to communicate with BDOS. For example, function number 1 designates console input and function number 2 indicates console output. Other numbers are used to designate console input and output buffer operations and disk operations. Function number 6, which was not defined in earlier versions, has been programmed for direct console I/O in Version 2.0. A binary six is placed into the C register and address five is called. Direct console input and output can both be performed in this way.

Function number 12 has been redefined. It was originally designated as a command to lift the disk head. But this operation is automatically handled by the hardware. Operation 12 is used in Version 2.0 to determine the version number of the CP/M operating system. The usage is a bit subtle. Programs such as BASIC and FORTRAN are usually sold for use on a single computer. These programs can now check the version number of the operating system through function number 12. A discrepancy indicates unauthorized usage on another machine or another operating system. Programs can be designed to abort in this case.

CHANGES TO THE BUILT-IN COMMANDS

Changes have been made to the built-in commands SAVE, ERA, and DIR. In addition, a new command USER has been added. A SAVE command in Version 1.4 destroyed the memory image after the new disk file had been constructed. With Version 2.0, the memory image is left intact. This is an extremely important change (at least for those of us who are poor typists). Suppose that, through a typing error, the user saved less than the required number of blocks. The save command could not be reissued with Version 1.4. But with Version 2.0, the save command can be immediately repeated, with the correct number of blocks. If space is needed on the diskette, then the first, incorrect copy can be erased with the ERA command. Then the correct save command can be given. It is also possible to view the new disk file by using the TYPE command. This command will not alter the memory image either.

Changes to the commands DIR and ERA relate to some of the new capabilities of the system. With Version 1.4, the program STAT could be used to designate a disk drive as read only. But the entire drive had to be so designated. Furthermore, the currently logged-in drive could not be write protected. With Version 2.0, individual files or any drive, in-

*CP/M is a registered trademark of Digital Research

cluding the current drive, can be designated as read only. Such files cannot be deleted by a simple ERA command. Neither can they be edited by ED.

The new USER command can be used to partition any disk into separate areas for up to sixteen users. The ERA command operates only on files belonging to the currently logged-in user.

CHANGES TO PIP AND STAT

The transient programs PIP and STAT have also been altered to account for the additional capabilities of Version 2.0. For example, the PIP command will not overwrite a protected file unless a W parameter is given. Files can also be copied from one user area to another on the same disk, with the same name. This is especially important with a hard disk where 30 megabytes could be logically divided into several parts.

STAT will indicate whether each listed file has been designated as read only (R/O) or read write (R/W). And, of course, STAT can be used to change this status. The command: A>STAT PASCAL.COM $R/O will designate the Pascal compiler as a read-only file. Another feature of Version 2.0 is that files can be designated as system files. The command is: A>STAT PIP.COM $SYS. Files so designated will not appear in the DIR listing. They will appear in a STAT listing, however, but in this case they are surrounded with a pair of parentheses to indicate that they are system files.

There are two new STAT commands. One of them is: A>STAT DSK:. The response is a list of the disk drive characteristics such as the total record capacity, the directory size and other information.

The other new STAT command: A>STAT USR: displays the current user number and the user numbers of all active users. A new user area can be established simply by typing: A>USER 1 (USER 0 is the default). At first, the new work area will be empty. PIP can be used to copy programs from other user areas, but there is no copy of PIP at this point. The solution is to return to USER 0, copy PIP into memory, change to USER 1, then give the SAVE command:

```
A>USER 0          (return to user zero)
A>PIP             (load PIP into memory)
*<or>             (return to system)
—GO               (return to system)
A>USER 1          (set to user 1)
A>SAVE 29 PIP.COM
```

PIP can now be used to copy files from other user areas into the current area. The command: A>PIP A:=A:STAT.COM[GO R V] will copy STAT from the area of user 0 into the current user area. Both copies will be on drive A, but in different user areas. The GO argument indicates that the copy should be gotten from work area zero. The R argument is needed if the file has been declared a system file. The V, as usual, requests verification of the transfer.

DOCUMENTATION

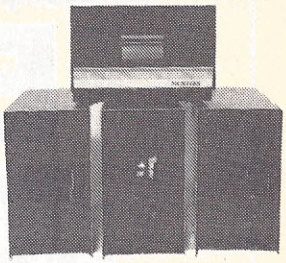
Three new manuals have been added for Version 2.0. These supplement the extensive set of documents written for Version 1.4. One particularly valuable addition is entitled: *CP/M 2.0 User's Guide for CP/M 1.4 Owners.* A second document of 46 pages — *CP/M 2.0 Interface Guide* — thoroughly discusses the usage of the BDOS functions for I/O and disk operations.

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The Lifeboat double-density, quad capacity Version 2.0 CP/M can be used on North Star disk systems. The three common types of 5-inch disks can be intermixed. These are the double-sided, double-density (quad) drives, the single-sided, double-density drives, and the single-density drives. Furthermore, the single-sided, double-density drives can be

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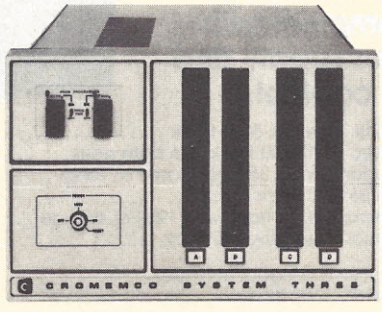
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set for Version 1.4 format or Version 2.0 format.

With the earlier version, there was a separate program called DENSITY that was used to designate the correct density of each drive. With Version 2.0 this is no longer necessary. The system automatically sets itself for the proper format by reading the diskette. If the system is booted up with a single-density diskette in drive B, then, when drive B is addressed, the directory is read and the drive type is set to single density.

If the single-density diskette is removed and replaced with a double-density, be sure to perform a warm start by giving a Control-C. This will automatically read the directory for drive B and reset the drive designation to 1.4 or 2.0 type-double density.

ADDING THE DATE AND TIME TO STAT

If you have a Computime date and time board in your computer, then you can easily have STAT print the date and time at the beginning of each listing. You can send the combined listing to the printer by giving the command of Control-P prior to giving the STAT command. Then, tear off the printer output, fold it, and put it into the corresponding diskette envelope.

There is room for the date and time routine in the last page of memory at the end of STAT. Type up the program given in Listing 1 and assemble it. Load STAT with DDT or SID:

```
A>SID STAT.COM
```

then load TIME

```
#ITIME.HEX
#R
```

This will load TIME over STAT and patch it properly. Finally, return to CP/M and save the combination:

```
A>SAVE 41 STATT.COM
```

Give it a new name at first until you try it out. When you find that it works properly, then erase STAT and rename STATT to STAT:

```
A>ERA STAT.COM
A>REN STAT.COM=STATT.COM
```

The program assumes that the ports for the time board are addressed to C4, C5, C6 and C7 HEX. If yours are different, you must change the definition of ADATA near the beginning of the program.

Another change will have to be made if you do not have a macro assembler. The passage:

```
PORT    SET     ADATA
        IRP     ?P,<70H,14H,77H,4>
        MVI     A,?P
        OUT     PORT
PORT    SET     PORT+1
        ENDM
```

uses the in-line macro IRP to generate the four pairs of instructions for setting the clock ports. These six lines can be replaced by the following eight lines:

```
        MVI     A,70H
        OUT     ADATA
        MVI     A,14H
        OUT     ACONT
        MVI     A,77H
        OUT     BDATA
        MVI     A,4
        OUT     BCONT
```

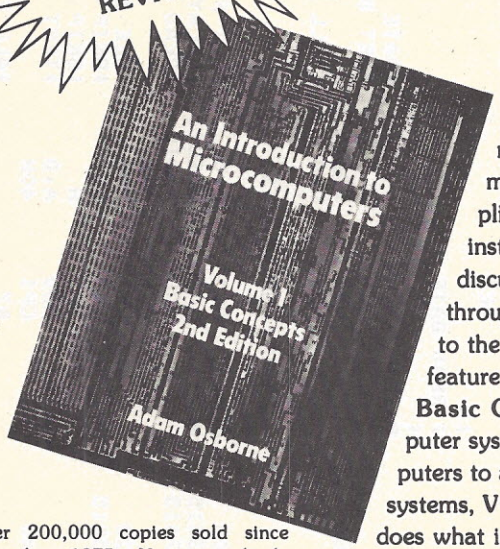
If the year is not 1980, then you will want to make a change in the program. The year is located at address 1594 HEX.□

Program follows

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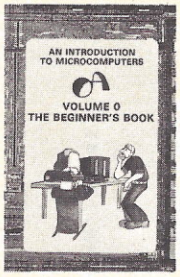
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S1089

LISTING 1
Program to add date and time to STAT

```
                        TITLE   'time for stat'

                ; JAN 2,80
                ; TIME AND DATE FROM A COMPU/TIME BOARD
                ; ADDED TO CP/M VERSION 2.0 STAT
                ;
                ; PROGRAMMED FOR AN 8080-Z80 MICROPROCESSOR
                ; BY ALAN R. MILLER
                ; NEW MEXICO TECH, SOCORRO, NM  87801
                ;
                ; PATCH CP/M STAT TO JUMP HERE.
                ; THE ORIGINAL VALUE WAS JMP 433H.
                ;
0100            ORG     100H
0100 C30215             JMP     TIME
                ;
                ; STAT ORIGINALLY ENDS AT 1501 HEX
                ; START TIME IMMEDIATELY AFTERWARD
                ;
1502            ORG     1502H           ;VERSION 2.0
                ;
0005 =          BDOS    EQU     5       ;BDOS ENTRY
0009 =          PBUF    EQU     9       ;PRINT STRING
000D =          CR      EQU     0DH     ;CARRIAGE RET
000A =          LF      EQU     0AH     ;LINE FEED
                ;
                ; COMPUTIME CLOCK PORTS
                ;
00C4 =          ADATA   EQU     0C4H    ;PORT A DATA
00C5 =          ACONT   EQU     ADATA+1 ;PORT A CONTROL
00C6 =          BDATA   EQU     ADATA+2 ;PORT B DATA
00C7 =          BCONT   EQU     ADATA+3 ;PORT B CONTROL
                ;
1502 DBC4       TIME:   IN      ADATA   ;BOARD PRESENT?
1504 FEFF               CPI     0FFH
1506 CA7F15             JZ      NOBRD   ;NO, QUIT
                ;
                ; INITIALIZE CLOCK PORTS
                ;
1509 AF                 XRA     A       ;GET A ZERO
150A D3C5               OUT     ACONT   ;RESET PORTS
150C D3C7               OUT     BCONT
                ;
00C4 #          PORT    SET     ADATA
                        IRP     ?P,<70H,14H,77H,4>
                        MVI     A,?P
                        OUT     PORT
                PORT    SET     PORT+1
                        ENDM
150E+3E70               MVI     A,70H
1510+D3C4               OUT     PORT
1512+3E14               MVI     A,14H
1514+D3C5               OUT     PORT
1516+3E77               MVI     A,77H
1518+D3C6               OUT     PORT
151A+3E04               MVI     A,4
151C+D3C7               OUT     PORT
                ;
151E 118E15             LXI     D,MON   ;MONTH, DAY
1521 CD4815             CALL    DATE    ;GET THEM
1524 119D15             LXI     D,HOUR  ;HR, MIN, SEC
1527 CD6615             CALL    TTIME   ;GET THEM
152A 118815             LXI     D,PDATE ;POINT TO ALL
152D 0E09               MVI     C,PBUF  ;PRINT BUFFER
152F CD0500             CALL    BDOS    ;SEND
                ;
                ; CONTINUE WITH CP/M STAT
                ;
1532 C33304     DONE:   JMP     433H
                ;
                ; READ A DIGIT
                ;
1535 7A         RDIGIT: MOV     A,D     ;SELECT DIGIT
1536 D3C4               OUT     ADATA
1538 DBC4               IN      ADATA   ;RESET INTERRUPT
153A DBC5       DWAIT:  IN      ACONT   ;TEST FOR DIGIT
153C E680               ANI     80H     ;ANYTHING THERE?
153E CA3A15             JZ      DWAIT   ;LOOP UNTIL READY
1541 DBC4               IN      ADATA   ;READ A DIGIT
1543 E60F               ANI     0FH     ;MASK   ZONE
1545 F630               ORI     30H     ;CONVERT TO ASCII
1547 C9                 RET
                ;
                ; READ DATE
                ;
1548 EB         DATE:   XCHG            ;DATE INTO H,L
1549 AF                 XRA     A       ;SET DATE DISPLAY MODE
154A D3C6               OUT     BDATA
154C 4F                 MOV     C,A     ;TELL READ4 THIS IS DATE
                ;
                ; READ FOUR DIGITS
                ;
154D 1600       READ4:  MVI     D,0     ;SET FOR FIRST DIGIT
154F CD3515     NEXT:   CALL    RDIGIT  ;DELAY ONE DIGIT SCAN
1552 CD7415             CALL    RSDIG   ;READ & STORE DIGIT
1555 7A                 MOV     A,D
1556 FE20               CPI     20H     ;SEE IF BOTH DONE
1558 C25C15             JNZ     SKIP    ;SKIP A PLACE
155B 23                 INX     H       ;SKIP OVER : OR /
155C 7A         SKIP:   MOV     A,D     ;TEST FOR ALL DIGITS DONE
155D FE40               CPI     40H
155F C8                 RZ              ;ALL FOUR DONE
```

```
1560 C34F15          JMP     NEXT    ;GET ANOTHER DIGIT
                     ;
                     ; STORE A DIGIT
                     ;
1563 77     SDIGIT:  MOV     M,A     ;STORE BYTE
1564 23              INX     H       ;INCR POINTER
1565 C9              RET
                     ;
                     ; READ TIME & READ AND STORE DIGIT
                     ;
1566 EB      TTIME:  XCHG            ;TIME INTO H,L
1567 3E40            MVI     A,40H   ;TIME DISPLAY MODE
1569 D3C6            OUT     BDATA
156B 0E01            MVI     C,1     ;TELL READ4 THIS IS TIME
156D CD4D15          CALL    READ4   ;GET 4 DIGITS
1570 23              INX     H
1571 CD7415          CALL    RSDIG
1574 CD3515  RSDIG:  CALL    RDIGIT
1577 CD6315          CALL    SDIGIT
157A 7A              MOV     A,D
157B C610            ADI     10H
157D 57              MOV     D,A
157E C9              RET
                     ;
                     ; NO CLOCK BOARD, SEND MESSAGE AND QUIT
                     ;
157F 11A615  NOBRD:  LXI     D,EMSG  ;ERROR MESS
1582 0E09            MVI     C,PBUF
1584 CD0500          CALL    BDOS    ;SEND
1587 C7              RST     0       ;QUIT
                     ;
                     ; STORAGE AREA
1588 0D44617465PDATE:DB      CR,'Date '
158E 78782F  MON:    DB      'xx/'   ;MONTH
1591 78782F          DB      'xx/'   ;DAY
1594 3830            DB      '80'    ;YEAR
1596 202054696D      DB      ' Time'
159D 78783A  HOUR:   DB      'xx:'   ;HOURS
15A0 78783A          DB      'xx:'   ;MINUTES
15A3 7878            DB      'xx'    ;SECONDS
15A5 24              DB      '$'
                     EMSG:
15A6 4E6F20636C      DB      'No clock board'
15B4 0D0A24          DB      CR,LF,'$'
                     ;
15B7                 END

00C5 ACONT   00C4 ADATA      00C7 BCONT      00C6 BDATA
0005 BDOS    000D CR         1548 DATE       1532 DONE
153A DWAIT   15A6 EMSG       159D HOUR       000A LF
158E MON     154F NEXT       157F NOBRD      0009 PBUF
1588 PDATE   1535 RDIGIT     154D READ4      1574 RSDIG
1563 SDIGIT  155C SKIP       1502 TIME       1566 TTIME
```


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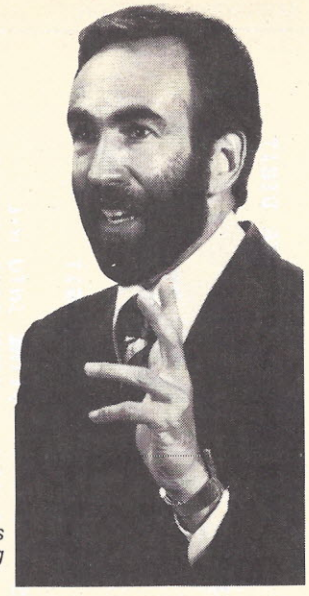
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My story is only one example of how the FTC is harassing small businesses but I'm not going to sit back and take it.

By Joseph Sugarman,
President, JS&A Group, Inc.

I'm pretty lucky. When I started my business in my basement eight years ago, I had little more than an idea and a product.

The product was the pocket calculator. The idea was to sell it through advertisements in national magazines and newspapers.

Those first years in the basement weren't easy. But, we worked hard and through imaginative advertising and a dedicated staff, JS&A grew rapidly to become well recognized as an innovator in electronics and marketing.

THREE BLIZZARDS

In January of 1979, three major blizzards struck the Chicago area. The heaviest snowfall hit Northbrook, our village – just 20 miles north of Chicago.

Many of our employees were stranded – unable to get to our office where huge drifts made travel impossible. Not only were we unable to reach our office, but our computer totally broke down leaving us in even deeper trouble.

But we fought back. Our staff worked around the clock and on weekends. First, we processed orders manually. We also hired a group of computer specialists, rented outside computer time, employed a computer service bureau, and hired temporary help to feed this new computer network. We never gave up. Our totally dedicated staff and the patience of many of our customers helped us through the worst few months in our history. Although there were many customers who had to wait over 30 days for their parcels, every package was eventually shipped.

WE OPENED OUR DOORS

During this period, some of our customers called the FTC (Federal Trade Commission) to complain. We couldn't blame them. Despite our efforts to manually notify our customers of our delays, our computer was not functioning making the task extremely difficult.

The FTC advised JS&A of these complaints. To assure the FTC that we were a responsible company, we invited them to visit us. During their visit we showed them our computerized microfilm system which we use to back up every transaction. We showed them our new dual computer system (our main system and a backup system in case our main system ever failed again). And, we demonstrated how we were able to locate and trace every order. We were very cooperative, allowing them to look at every document they requested.

The FTC left. About one week later, they called and told us that they wanted us to pay a $100,000 penalty for not shipping our products within their 30-day rule. (The FTC rule states that anyone paying by check is entitled to have their purchase shipped within 30 days or they must be notified and given the option to cancel.)

NOT BY CONGRESS

The FTC rule is not a law nor a statute passed by Congress, but rather a rule created by the FTC to strengthen their enforcement powers. I always felt that the rule was intended to be used against companies that purposely took advantage of the consumer. Instead, it appears that the real violators, who often are too difficult to prosecute, get away while JS&A, a visible and highly respected company that pays taxes and has contributed to our free enterprise system, is singled out. I don't think that was the intent of the rule.

And when the FTC goes to court, they have the full resources of the US Government. Small, legitimate businesses haven't got a chance.

We're not perfect. We do make mistakes. But if we do make a mistake, we admit it, accept the responsibility, and then take whatever measures necessary to correct it. That's how we've built our reputation.

BLOW YOUR KNEE CAPS OFF

Our attorneys advised us to settle. As one attorney said, "It's like a bully pulling out a gun and saying, 'If you don't give me a nickel, I'll blow your knee caps off.'" They advised us that the government will subpoena thousands of documents to harass us and cause us great inconvenience. They warned us that even if we went to court and won, we would end up spending more in legal fees than if we settled.

To settle would mean to negotiate a fine and sign a consent decree. The FTC would then issue a press release publicizing their victory.

At first we tried to settle. We met with two young FTC attorneys and agreed in principle to pay consumers for any damages caused them. But there were practically no damages, just a temporary computer problem, some late shipments, and some bad weather. The FTC then issued a massive subpoena requesting documents that will take us months to gather and which we feel was designed to harass or force us to accept their original $100,000 settlement request.

Remember, the FTC publicizes their actions. And the higher the fine, the more the publicity and the more stature these two attorneys will have at the FTC.

If this all sounds like blackmail – that's just what it appeared to be to us.

We did ship our products late – something we've admitted to them and which we publicly admit here, but we refuse to be blackmailed into paying a huge fine at the expense of our company's reputation – something we've worked hard eight years to build.

We're not a big company and we realize it would be easier to settle now at any cost. But we're not. If this advertisement can attract the attention of Congressmen and Senators who have the power to stop the harassment of Americans by the FTC, then our efforts will be well spent.

ALL AMERICANS AFFECTED

Federal regulation and the whims of a few career-building bureaucrats is costing taxpayers millions, destroying our free enterprise system, affecting our productivity as a nation and as a result is lowering everybody's standard of living.

I urge Congressmen, Senators, businessmen and above all, the consumer to support legislation to take the powers of the FTC from the hands of a few unelected officials and bring them back to Congress and the people.

I will be running this advertisement in hundreds of magazines and newspapers during the coming months. I'm not asking for contributions to support my effort as this is my battle, but I do urge you to send this advertisement to your Congressmen and Senators. That's how you can help.

America was built on the free enterprise system. Today, the FTC is undermining this system. Freedom is not something that can be taken for granted and you often must fight for what you believe. I'm prepared to lead that fight. Please help me.

Note: To find out the complete story and for a guide on what action you can take, write me personally for my free booklet, "Blow your knee caps off."

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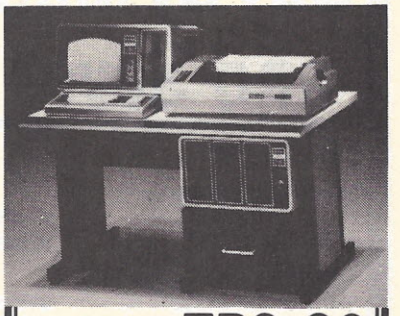
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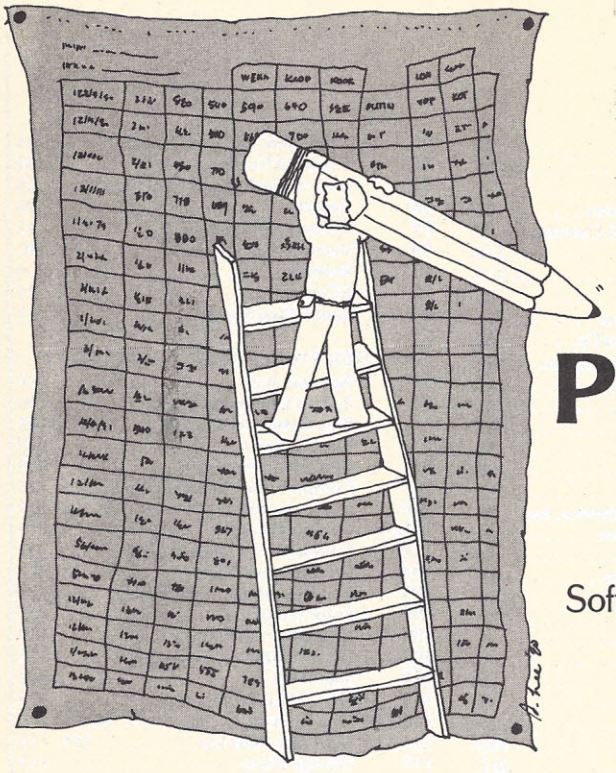
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Personal Software's VISICALC

Software Product Review by Tom Fox, Systems Editor

One of the exciting aspects of working in the microcomputer industry is witnessing the marriage of clever minds and that most powerful of mind-stretching tools, the computer. Brilliant people trained in a variety of disciplines are finding the computer to be a means of expressing their considerable creativity, and the results would surely delight Boole, Babbage and, in this case, the makers of Apple.

While a student at the Harvard Business School, Dan Bricklin found he was spending a discouraging amount of time writing (and re-writing) "pro forma" balance sheets. Armed with a pocket calculator and large sheets of blank paper, Dan would fill in endless rows and columns of financial data — scenarios for the financial condition of corporations that existed only in the minds of Harvard professors.

Once completed, it was a massive task to (for example) insert a row or column of information, and to extend the results of such a disruption to the bottom line and right-hand column.

Now with Software Arts of Arlington, Massachusetts, he somehow transferred those long nights of fiscal frustration into the definition of a remarkable software product called VISICALC. Elegantly simple in concept, VISICALC may have a profound affect on the shape of data-handling programs for a long time to come.

Imagine a blackboard as big as a wall, with space for more than 250 rows and 60 columns. Into each spot that is formed by the intersection of a row and column can be put a number (dollar amount, etc.) or up to 250 characters of variable text. You look at the blackboard through the "window" of a CRT screen. Because the window is a small one (20 rows deep by 12 or fewer columns wide), there is a means to move the window around on the blackboard. Any portion of the board can be viewed by pushing the up, down, left and right arrows on the keyboard.

The tricky part is that you can define mathematical relationships between any of the rows and columns. The simplest example is to command that the bottom row be the sum of each of the rows above. More arcane relationships — percentages, common financial relationships, log and trig functions — are just as easy to define.

Whenever any item on the blackboard is changed, all other items that depend on the value of that item automatically change also. New rows and columns can be inserted, and existing ones moved around, while the values of all other dependent items are updated without any other action by the user. (Replacing a numeric value with "NA" reminds one of falling dominoes as all other numbers that once depended on that value flip to "NA" also.)

VISICALC definitely comes under the category of "why didn't I think of that?", and many of its concepts will doubtless be copied widely. The beauty of VISICALC, though, lies in its execution, which must be seen in action to be appreciated. The program was coded by Bob Frankston, who applied most of the tricks of people/computer interaction learned while creating commercial word processing programs.

The screen is a lively one, using memory-mapped I/O for speed and logical use of the keyboard functions to provide a natural interface with the user. You feel like you are "talking" to the blackboard, not the computer. Pushing the "arrow" keys causes a white box to jump around on the screen, highlighting each item. The top row of the screen continuously shows the mathematical relationships that exist between the highlighted item and all other items on the blackboard, as well as the amount of memory remaining to add new items.

A snapshot of the blackboard can be saved at any time onto cassette tape, minifloppy diskette or printer. A rich variety of keystroke-saving routines are available for the experienced user, although it isn't necessary to use them.

The program is currently available only for Apple computers, although plans are to add PET, Radio Shack and Atari to the list. The program is large: 12,000 lines of assembly language code, taking up 20,000 bytes of memory in the Apple. Personal Software Inc., the MICROCHESS people and now purveyors of VISICALC, recommend 32K of memory as the minimum configuration. That much memory would hold the VISICALC program and enough data for a 120-item checkbook balancing scenario. We would recommend 48K for any serious application.□

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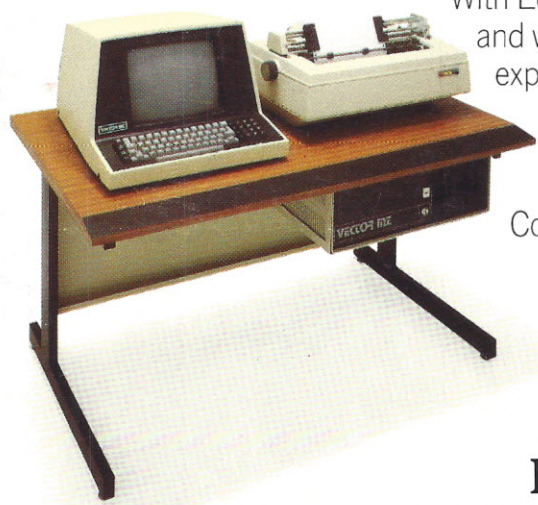
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